CHAPTER 15

Performance Monitoring

Note The terms "Unidirectional Path Switched Ring" and "UPSR" may appear in Cisco literature. These terms do not refer to using Cisco ONS 15xxx products in a unidirectional path switched ring configuration. Rather, these terms, as well as "Path Protected Mesh Network" and "PPMN," refer generally to Cisco's path protection feature, which may be used in any topological network configuration. Cisco does not recommend using its path protection feature in any particular topological network configuration.

Performance monitoring (PM) parameters are used by service providers to gather, store, set thresholds, and report performance data for early detection of problems. In this chapter, PM parameters and concepts are defined for electrical cards, Ethernet cards, and optical cards in the Cisco ONS 15454 SDH.

For information about enabling and viewing PM values, refer to the *Cisco ONS 15454 SDH Procedure Guide*.

Chapter topics include:

- 15.1 Threshold Performance Monitoring, page 15-1
- 15.2 Intermediate-Path Performance Monitoring, page 15-2
- 15.3 Pointer Justification Count Performance Monitoring, page 15-3
- 15.4 Performance Monitoring for Electrical Cards, page 15-3
- 15.5 Performance Monitoring for Ethernet Cards, page 15-14
- 15.6 Performance Monitoring for Optical Cards, page 15-21
- 15.7 Performance Monitoring for the Fiber Channel Card, page 15-54
- 15.8 Performance Monitoring for DWDM Cards, page 15-57

Note For additional information regarding PM parameters, refer to ITU G.826, and Telcordia documents GR-820-CORE, GR-499-CORE, and GR-253-CORE.

15.1 Threshold Performance Monitoring

Thresholds are used to set error levels for each PM parameter. You can set individual PM threshold values from the Cisco Transport Controller (CTC) card view Provisioning tab. For procedures on provisioning card thresholds, such as line, path, and SDH thresholds, refer to the *Cisco ONS 15454 SDH Procedure Guide*.

During the accumulation cycle, if the current value of a performance monitoring parameter reaches or exceeds its corresponding threshold value, a threshold crossing alert (TCA) is generated by the node and displayed by CTC. TCAs provide early detection of performance degradation. When a threshold is crossed, the node continues to count the errors during a given accumulation period. If 0 is entered as the threshold value, the performance monitoring parameter is disabled.

Change the threshold if the default value does not satisfy your error monitoring needs. For example, customers with a critical E1 installed for 911 calls must guarantee the best quality of service on the line; therefore, they lower all thresholds so that the slightest error raises a TCA.

15.2 Intermediate-Path Performance Monitoring

Intermediate-path performance monitoring (IPPM) allows transparent monitoring of a constituent channel of an incoming transmission signal by a node that does not terminate that channel. Many large ONS 15454 SDH networks only use line terminating equipment (LTE), not path terminating equipment (PTE). Table 15-1 shows ONS 15454 SDH cards that are considered LTE.

Table 15-1 Line Terminating Equipment (LTE)

Electrical LTE	
STM1E-12	—
Optical LTE	
OC3 IR 4/STM1 SH 1310	OC3 IR/STM1 SH 1310-8
OC12 IR/STM4 SH1310	OC12 LR/STM4 LH1310
OC12 LR/STM4 LH 1550	OC12 IR/STM4 SH 1310-4
OC48 IR/STM16 SH AS 1310	OC48 LR/STM16 LH AS 1550
OC48 ELR/STM16 EH 100 GHz	OC192 SR/STM64 IO 1310
OC192 IR/STM64 SH 1550	OC192 LR/STM64 LH 1550
OC192 LR/STM64 LH ITU 15xx.xx	TXP_MR_10G
MXP_2.5G_10G	—

Software Release 3.0 (R3.0) and later allows LTE cards to monitor near-end PM data on individual high-order paths by enabling IPPM. After enabling IPPM provisioning on the line card, service providers can monitor high-order paths that are configured in pass-through mode on an ONS 15454 SDH operating in SDH AU4 mode, thus making troubleshooting and maintenance activities more efficient.

IPPM occurs only on high-order paths that have IPPM enabled, and TCAs are raised only for PM parameters on the IPPM enabled paths. The monitored IPPM parameters are HP-EB, HP-BBE, HP-ES, HP-SES, HP-UAS, HP-ESR, HP-SESR, and HP-BBER.

Note The E1 card and STM-1 card can monitor far-end IPPM. For all other cards listed in Table 15-1, far-end IPPM is not supported. However, SDH path PM parameters can be monitored by logging into the far-end node directly.

The ONS 15454 SDH performs IPPM by examining the overhead in the monitored path and by reading all of the near-end path PM values in the incoming direction of transmission. The IPPM process allows the path signal to pass bidirectionally through the node completely unaltered.

For detailed information about specific IPPM parameters, locate the card name in the following sections and review the appropriate definition.

15.3 Pointer Justification Count Performance Monitoring

Pointers are used to compensate for frequency and phase variations. Pointer justification counts indicate timing errors on SDH networks. When a network is out of sync, jitter and wander occurs on the transported signal. Excessive wander can cause terminating equipment to slip.

Slips cause different effects in service. Voice service has intermittent audible clicks. Compressed voice technology has short transmission errors or dropped calls. Fax machines lose scanned lines or experience dropped calls. Digital video transmission has distorted pictures or frozen frames. Encryption service loses the encryption key causing data to be transmitted again.

Pointers provide a way to align the phase variations in VC4 payloads. The VC4 payload pointer is located in the H1 and H2 bytes of the AU pointers section and is a count of the number of bytes the VC4 path overhead (POH) J1 byte is away from the H3 byte, not including the section overhead bytes. Clocking differences are measured by the offset in bytes from the pointer to the first byte of the VC4 POH called the J1 byte. Clocking differences that exceed the normal range of 0 to 782 can cause data loss.

There are positive (PPJC) and negative (NPJC) pointer justification count parameters. PPJC is a count of path-detected (PPJC-Pdet) or path-generated (PPJC-Pgen) positive pointer justifications. NPJC is a count of path-detected (NPJC-Pdet) or path-generated (NPJC-Pgen) negative pointer justifications depending on the specific PM name.

A consistent pointer justification count indicates clock synchronization problems between nodes. A difference between the counts means the node transmitting the original pointer justification has timing variations with the node detecting and transmitting this count. Positive pointer adjustments occur when the frame rate of the POH is too slow in relation to the rate of the VC4.

You must enable PPJC and NPJC performance monitoring parameters for LTE cards. See Table 15-1 on page 15-2 for a list of Cisco ONS 15454 SDH LTE cards. In CTC, the count fields for PPJC and NPJC PM parameters appear white and blank unless they are enabled on the card view Provisioning tab.

For detailed information about specific pointer justification count PM parameters, locate the card name in the following sections and review the appropriate definition.

15.4 Performance Monitoring for Electrical Cards

The following sections define performance monitoring parameters for the E1-N-14, E1-42, E3-12, and DS3i-N-12 electrical cards.

15.4.1 E1-N-14 Card and E1-42 Card Performance Monitoring Parameters

Figure 15-1 on page 15-4 shows the signal types that support near-end and far-end PM parameters for the E1-N-14 card and the E1-42 card.

Figure 15-1 Monitored Signal Types for the E1-N-14 Card and E1-42 Card

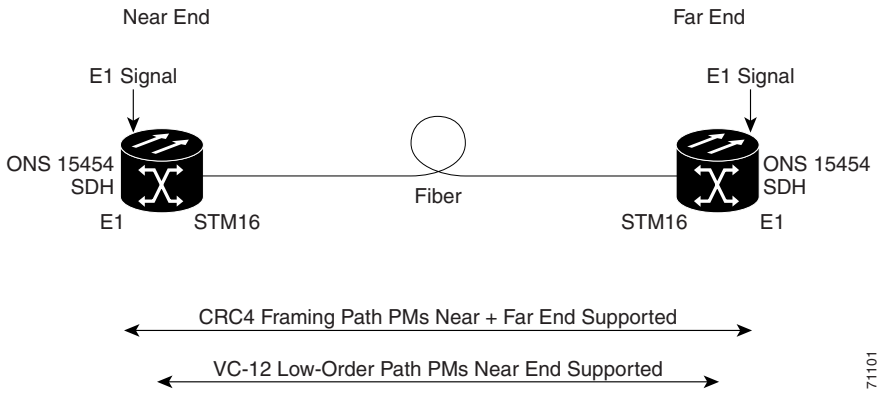
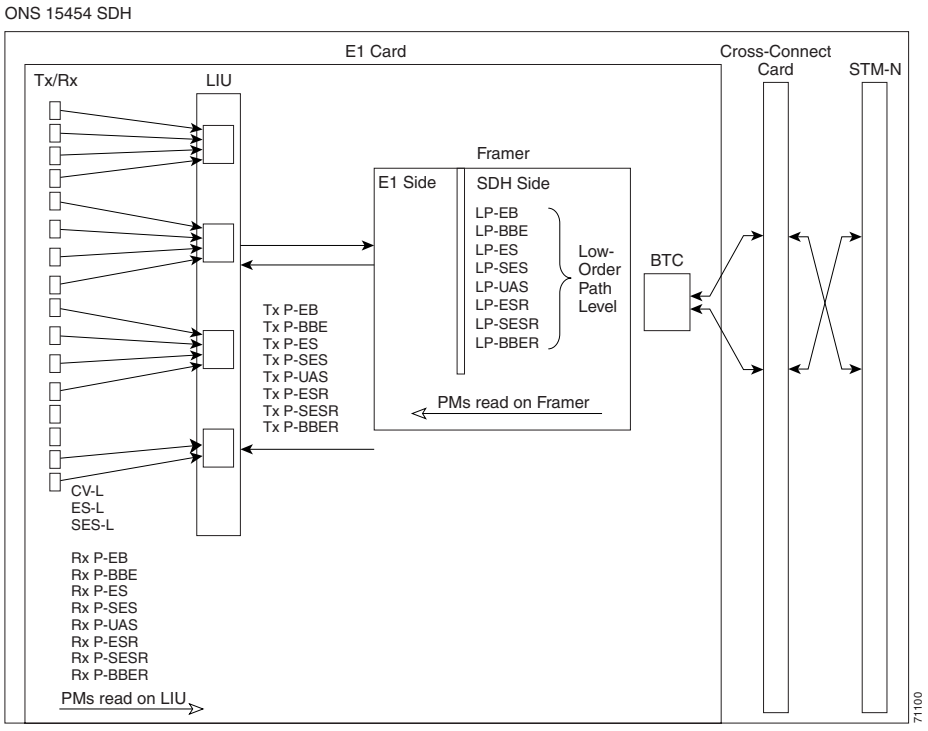


Figure 15-2 shows where overhead bytes detected on the application-specific integrated circuits (ASICs) produce performance monitoring parameters for the E1-N-14 card.

Note The E1-42 card uses the same PM read points. The only difference from the Figure 15-2 is that the number of ports on the E1-42 equal 42.

Figure 15-2 PM Read Points on the E1-N-14 Card



The PM parameters for the E1-N-14 card and E1-42 card are described in Table 15-2 on page 15-5 through Table 15-4 on page 15-6.

Table 15-2 Line PM Parameters for the E1-N-14 Card and E1-42 Card, Near-End

Parameter	Definition
Note SDH path PMs do not increment unless IPPM is enabled. See the "15.2 Intermediate-Path Performance Monitoring" section on page 15-2.	
E1 CV-L	Code Violation Line (CV-L) indicates the number of coding violations occurring on the line. This parameter is a count of bipolar violations (BPVs) and excessive zeros (EXZs) occurring over the accumulation period.
E1 ES-L	Errored Seconds Line (ES-L) is a count of the seconds containing one or more anomalies (BPV + EXZ) and/or defects (loss of signal) on the line.
E1 SES-L	Severely Errored Seconds Line (SES-L) is a count of the seconds containing more than a particular quantity of anomalies (BPV + EXZ ≥ 2048) and/or defects on the line.
E1 LOSS-L	Line Loss of Signal (LOSS-L) is a count of one-second intervals containing one or more LOS defects.

Table 15-3 Transmit and Receive CEPT and CRC4 Framing Path PM Parameters for the Near-End and Far-End E1-N-14 Cards and E1-42 Cards

Parameter	Definition
Note Under the Provisioning > Threshold tab, the E1-N-14 card and the E1-42 card have user-defined thresholds for the E-1 Rx path PM parameters. In the Threshold tab, they are displayed as EB, BBE, ES, SES, and UAS without the Rx prefix.	
E1 (Tx or Rx) P-EB	Path Errored Block (P-EB) indicates that one or more bits are in error within a block.
E1 (Tx or Rx) P-BBE	Path Background Block Error (P-BBE) is an errored block not occurring as part of an SES.
E1 (Tx or Rx) P-ES	Path Errored Second (P-ES) is a one-second period with one or more errored blocks or at least one defect.
E1 (Tx or Rx) P-SES	Path Severely Errored Seconds (P-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect; SES is a subset of ES.
E1 (Tx or Rx) P-UAS	Receive Path Unavailable Seconds (E1 Rx P-UAS) is a count of one-second intervals when the E-1 path is unavailable on the signal receive end. The E-1 path is unavailable when ten consecutive SESs occur. The ten SESs are included in unavailable time. After the E-1 path becomes unavailable, it becomes available when ten consecutive seconds occur with no SESs. The ten seconds with no SESs are excluded from unavailable time. Transmit Path Unavailable Seconds (E1 Tx P-UAS) is a count of one-second intervals when the E-1 path is unavailable on the transmit end of the signal. The E-1 path is unavailable when ten consecutive SESs occur. The ten SESs are included in unavailable time. After the E-1 path becomes unavailable, it becomes available when ten consecutive seconds occur with no SESs. The ten seconds with no SESs are excluded from unavailable time.

Table 15-3 Transmit and Receive CEPT and CRC4 Framing Path PM Parameters for the Near-End and Far-End E1-N-14 Cards and E1-42 Cards (continued)

Parameter	Definition
E1 (Tx or Rx) P-AISS	AIS Seconds Path (P-AISS) is a count of one-second intervals containing one or more AIS defects.
E1 (Tx or Rx) P-ESR	Path Errored Second Ratio (P-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
E1 (Tx or Rx) P-SESR	Path Severely Errored Second Ratio (P-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
E1 (Tx or Rx) P-BBER	Path Background Block Error Ratio (P-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 15-4 VC-12 Low-Order Path PM Parameters for the Near-End and Far-End E1-N-14 Cards and E1-42 Cards

Parameter	Definition
LP-EB	Low-Order Path Errored Block (LP-EB) indicates that one or more bits are in error within a block.
LP-ES	Low-Order Path Errored Second (LP-ES) is a one-second period with one or more errored blocks or at least one defect.
LP-SES	Low-Order Path Severely Errored Seconds (LP-SES) is a one-second period containing greater than or equal to 30 percent errored blocks or at least one defect. SES is a subset of ES.
LP-UAS	Low-Order Path Unavailable Seconds (LP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as LP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as LP-SESs.
LP-BBE	Low-Order Path Background Block Error (LP-BBE) is an errored block not occurring as part of an SES.
LP-ESR	Low-Order Path Errored Second Ratio (LP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
LP-SESR	Low-Order Path Severely Errored Second Ratio (LP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
LP-BBER	Low-Order Path Background Block Error Ratio (LP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.4.2 E3-12 Card Performance Monitoring Parameters

Figure 15-3 shows the signal types that support near-end and far-end PM parameters for the E3-12 card. Figure 15-4 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the E3-12 card.

Figure 15-3 Monitored Signal Types for the E3-12 Card

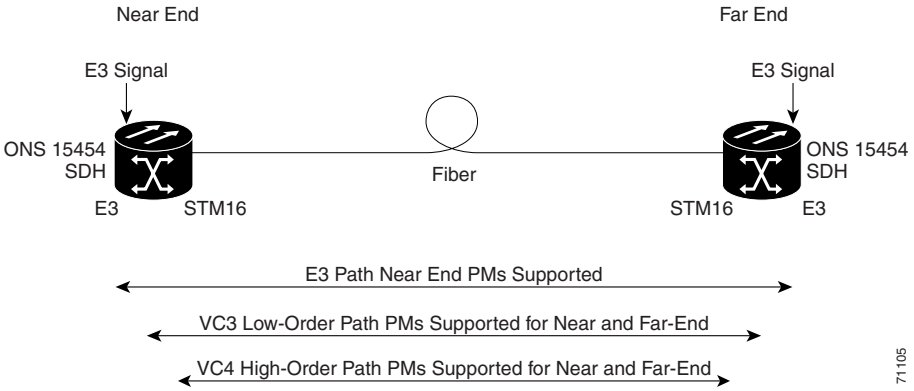
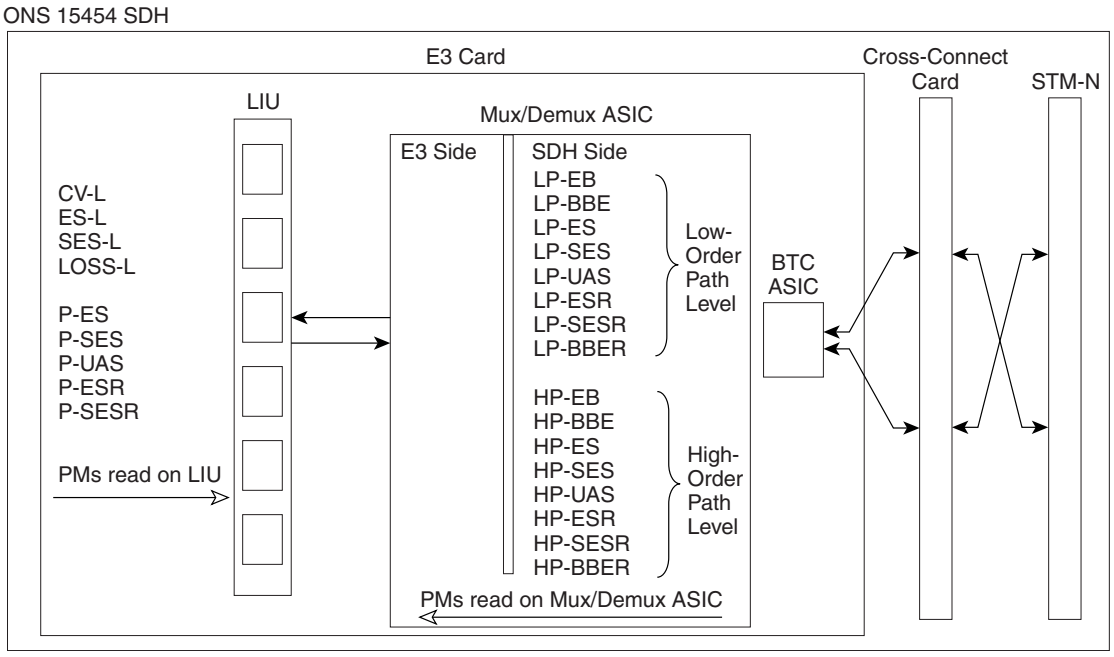


Figure 15-4 PM Read Points on the E3-12 Card



The PM parameters for the E3-12 card are described in Table 15-5 on page 15-8 through Table 15-8 on page 15-9.

Table 15-5 Line PM Parameters for the Near-End E3-12 Card

Parameter	Definition
E3 CV-L	Code Violation Line (CV-L) indicates that the number of coding violations occurring on the line. This parameter is a count of BPVs and EXZs occurring over the accumulation period.
E3 ES-L	Errored Seconds Line (ES-L) is a count of the seconds containing one or more anomalies (BPV + EXZ) and/or defects (loss of signal) on the line.
E3 SES-L	Severely Errored Seconds Line (SES-L) is a count of the seconds containing more than a particular quantity of anomalies (BPV + EXZ $\geq$ 44) and/or defects on the line.
E3 LOSS-L	Line Loss of Signal (LOSS-L) is a count of one-second intervals containing one or more LOS defects.

Table 15-6 Path PM Parameters for the Near-End E3-12 Card

Parameter	Definition
E3 P-ES	Path Errored Second (P-ES) is a one-second period with at least one defect.
E3 P-SES	Path Severely Errored Seconds (P-SES) is a one-second period containing at least one defect. SES is a subset of ES.
E3 P-UAS	Path Unavailable Seconds (P-UAS) is a count of the seconds when the path was unavailable. A path becomes unavailable when ten consecutive seconds occur that qualify as P-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as P-SESs.
E3 P-ESR	Path Errored Second Ratio (P-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
E3 P-SESR	Path Severely Errored Second Ratio (P-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.

Table 15-7 VC3 Low-Order Path PM Parameters for the Near-End and Far-End E3-12 Card

Parameter	Definition
LP-EB	Low-Order Path Errored Block (LP-EB) indicates that one or more bits are in error within a block.
LP-BBE	Low-Order Path Background Block Error (LP-BBE) is an errored block not occurring as part of an SES.
LP-ES	Low-Order Path Errored Second (LP-ES) is a one-second period with one or more errored blocks or at least one defect.
LP-SES	Low-Order Path Severely Errored Seconds (LP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-7 VC3 Low-Order Path PM Parameters for the Near-End and Far-End E3-12 Card (continued)

Parameter	Definition
LP-UAS	Low-Order Path Unavailable Seconds (LP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as LP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as LP-SESs.
LP-ESR	Low-Order Path Errored Second Ratio (LP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
LP-SESR	Low-Order Path Severely Errored Second Ratio (LP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
LP-BBER	Low-Order Path Background Block Error Ratio (LP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 15-8 VC4 High-Order Path PM Parameters for the Near-End and Far-End E3-12 Card

Parameter	Definition
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.4.3 DS3i-N-12 Card Performance Monitoring Parameters

Figure 15-5 shows the signal types that support near-end and far-end PM parameters for the DS3i-N-12 card. Figure 15-6 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the DS3i-N-12 card.

Figure 15-5 Monitored Signal Types for the DS3i-N-12 Card

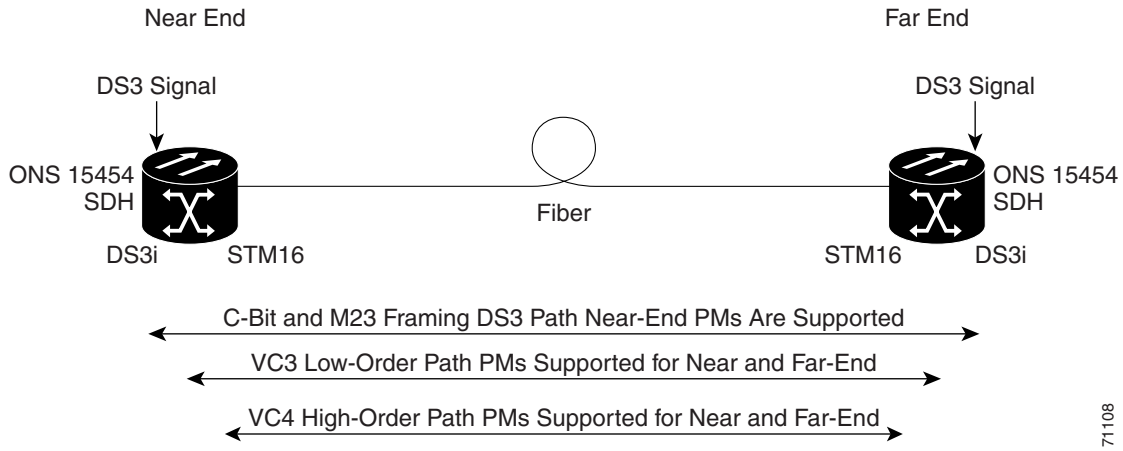
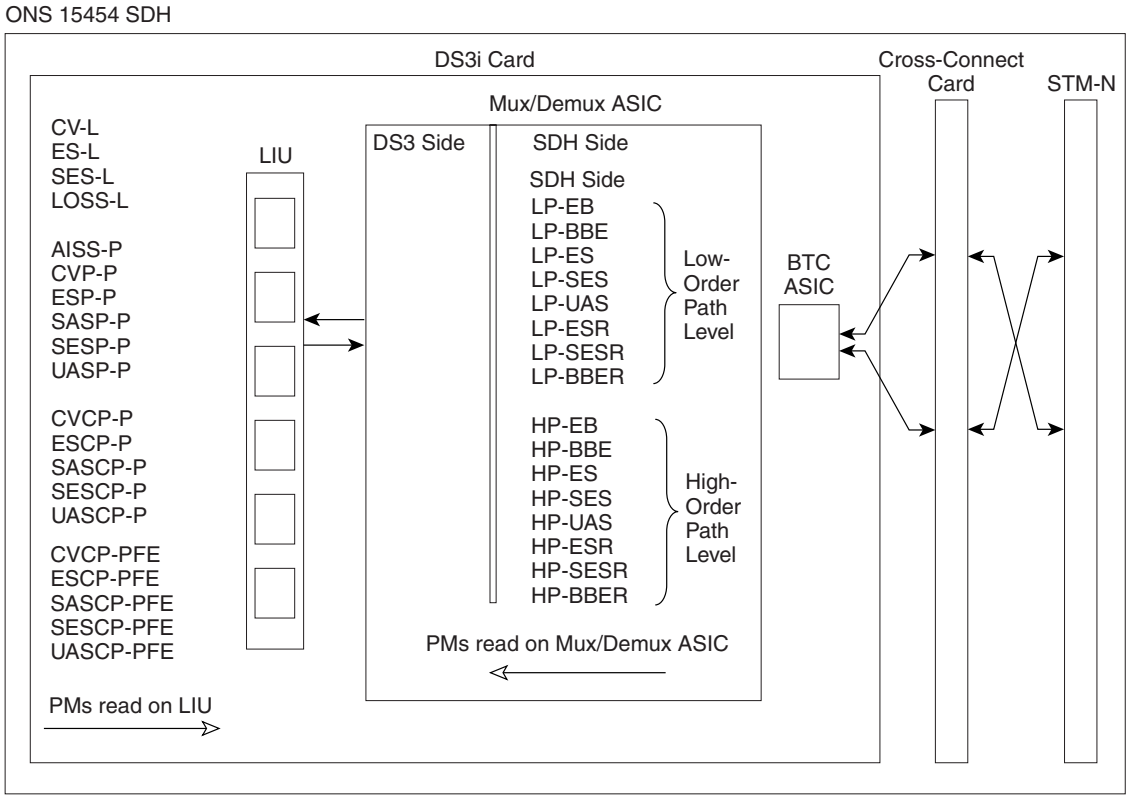


Figure 15-6 PM Read Points on the DS3i-N-12 Card



The PM parameters for the DS3i-N-12 card are described in Table 15-9 through Table 15-14 on page 15-13.

Table 15-9 Line PM Parameters for the Near-End DS3i-N-12 Card

Parameter	Definition
DS3 CV-L	Code Violation Line (CV-L) indicates that the number of coding violations occurring on the line. This parameter is a count of BPVs and EXZs occurring over the accumulation period.
DS3 ES-L	Errored Seconds Line (ES-L) is a count of the seconds containing one or more anomalies (BPV + EXZ) and/or defects (for example, LOS) on the line.
DS3 SES-L	Severely Errored Seconds Line (SES-L) is a count of the seconds containing more than a particular quantity of anomalies (BPV + EXZ ≥ 44) and/or defects on the line.
DS3 LOSS-L	Line Loss of Signal (LOSS-L) is a count of one-second intervals containing one or more LOS defects.

Table 15-10 C-Bit and M23 Framing Path PM Parameters for the Near-End DS3i-N-12 Card

Parameter	Definition
DS3 CVP-P	Code Violation Path (CVP-P) is a code violation parameter for M23 applications. CVP-P is a count of P-bit parity errors occurring in the accumulation period.
DS3 ESP-P	Errored Second Path (ESP-P) is a count of seconds containing one or more P-bit parity errors, one or more severely errored framing (SEF) defects, or one or more AIS defects.
DS3 SESP-P	Severely Errored Seconds Path (SESP-P) is a count of seconds containing more than 44 P-bit parity violations, one or more SEF defects, or one or more AIS defects.
DS3 SASP-P	SEF/AIS Seconds Path (SASP-P) is a count of one-second intervals containing one or more SEFs or one or more AIS defects on the path.
DS3 UASP-P	Unavailable Second Path (UASP-P) is a count of one-second intervals when the DS-3 path is unavailable. A DS3 path becomes unavailable when ten consecutive SESP-Ps occur. The ten SESP-Ps are included in unavailable time. After the DS-3 path becomes unavailable, it becomes available when ten consecutive seconds with no SESP-Ps occur. The ten seconds with no SESP-Ps are excluded from unavailable time.
DS3 AISS-P	AIS Seconds Path (AISS-P) is a count of one-second intervals containing one or more AIS defects.

Table 15-11 CP-Bit Framing DS-3 Path PM Parameters for the Near-End DS3i-N-12 Card

Parameter	Definition
DS3 CVCP-P	Code Violation Path (CVCP-P) is a count of CP-bit parity errors occurring in the accumulation period.
DS3 ESCP-P	Errored Second Path (ESCP-P) is a count of seconds containing one or more CP-bit parity errors, one or more SEF defects, or one or more AIS defects. ESCP-P is defined for the C-bit parity application.
DS3 SESCP-P	Severely Errored Seconds Path (SESCP-P) is a count of seconds containing more than 44 CP-bit parity errors, one or more SEF defects, or one or more AIS defects.
DS3 SASCP-P	SEF/AIS Second (SASCP-P) is a count of one-second intervals containing one or more near-end SEF/AIS defects.
DS3 UASCP-P	Unavailable Second Path (UASCP-P) is a count of one-second intervals when the DS-3 path is unavailable. A DS-3 path becomes unavailable when ten consecutive SESCP-Ps occur. The ten SESCP-Ps are included in unavailable time. After the DS-3 path becomes unavailable, it becomes available when ten consecutive seconds with no SESCP-Ps occur. The ten seconds with no SESCP-Ps are excluded from unavailable time.

Table 15-12 CP-Bit Path PM Parameters for the Far-End DS3i-N-12 Card

Parameter	Definition
DS3 CVCP-P	Code Violation (CVCP-P) is a parameter that is counted when the three far-end block error (FEBE) bits in a M-frame are not all collectively set to 1.
DS3 ESCP-P	Errored Second (ESCP-P) is a count of one-second intervals containing one or more M-frames with the three FEBE bits not all collectively set to 1 or one or more far-end SEF/AIS defects.
DS3 SASCP-P	SEF/AIS Second (SASCP-P) is a count of one-second intervals containing one or more far-end SEF/AIS defects.
DS3 SESCP-P	Severely Errored Second (SESCP-P) is a count of one-second intervals containing one or more 44 M-frames with the three FEBE bits not all collectively set to 1 or one or more far-end SEF/AIS defects.
DS3 UASCP-P	Unavailable Second (UASCP-P) is a count of one-second intervals when the DS-3 path becomes unavailable. A DS-3 path becomes unavailable when ten consecutive far-end CP-bit SESs occur. The ten CP-bit SESs are included in unavailable time. After the DS-3 path becomes unavailable, it becomes available when ten consecutive seconds occur with no CP-bit SESs. The ten seconds with no CP-bit SESs are excluded from unavailable time.

Table 15-13 VC3 Low-Order Path PM Parameters for the Near-End and Far-End DS3i-N-12 Cards

Parameter	Definition
LP-EB	Low-Order Path Errored Block (LP-EB) indicates that one or more bits are in error within a block.
LP-BBE	Low-Order Path Background Block Error (LP-BBE) is an errored block not occurring as part of an SES.
LP-ES	Low-Order Path Errored Second (LP-ES) is a one-second period with one or more errored blocks or at least one defect.
LP-SES	Low-Order Path Severely Errored Seconds (LP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
LP-UAS	Low-Order Path Unavailable Seconds (LP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as LP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as LP-SESs.
LP-ESR	Low-Order Path Errored Second Ratio (LP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
LP-SESR	Low-Order Path Severely Errored Second Ratio (LP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
LP-BBER	Low-Order Path Background Block Error Ratio (LP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 15-14 VC4 High-Order Path PM Parameters for the Near-End and Far-End DS3i-N-12 Cards

Parameter	Definition
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.

Table 15-14 VC4 High-Order Path PM Parameters for the Near-End and Far-End DS3i-N-12 Cards (continued)

Parameter	Definition
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.5 Performance Monitoring for Ethernet Cards

The following sections define performance monitoring parameters and definitions for the E-Series, G-Series, and ML-Series Ethernet cards.

15.5.1 E-Series Ethernet Card Performance Monitoring Parameters

CTC provides Ethernet performance information, including line-level parameters, port bandwidth consumption, and historical Ethernet statistics. The E-Series Ethernet performance information is divided into the Statistics, Utilization, and History tabbed windows within the card view Performance tab window. The following sections describe PM parameters provided for the E100T-G and E1000-2 Ethernet cards.

15.5.1.1 E-Series Ethernet Statistics Window

The Ethernet statistics window lists Ethernet parameters at the line level. The Statistics window provides buttons to change the statistical values shown. The Baseline button resets the displayed statistics values to zero. The Refresh button manually refreshes statistics. Auto-Refresh sets a time interval at which automatic refresh occurs.

Table 15-15 defines the E-Series Ethernet card Statistics parameters.

Table 15-15 E-Series Ethernet Statistics Parameters

Parameter	Meaning
Link Status	Link integrity indicator (up means present, and down means not present).
Rx Packets	Number of packets received since the last counter reset.
Rx Bytes	Number of bytes received since the last counter reset.
Tx Packets	Number of packets transmitted since the last counter reset.
Tx Bytes	Number of bytes transmitted since the last counter reset.
Rx Total Errors	Total number of receive errors.

Table 15-15 E-Series Ethernet Statistics Parameters (continued)

Parameter	Meaning
Rx FCS	Number of packets with a Frame Check Sequence (FCS) error. FCS errors indicate frame corruption during transmission.
Rx Alignment	Number of packets with alignment errors (received incomplete frames).
Rx Runts	Measures undersized packets with bad cyclic redundancy check (CRC) errors.
Rx Shorts	Measures undersized packets with good cyclic redundancy check (CRC) errors.
Rx Oversized + Jabbers	Measures oversized packets and jabbers. Size is greater than 1522 errors regardless of cyclic redundancy check (CRC) errors.
Rx Giants	Number of packets received that are greater than 1518 bytes in length for untagged interfaces and 1522 bytes for tagged interfaces.
Tx Collisions	Number of transmit packets that are collisions; the port and the attached device transmitting at the same time caused collisions.
Tx Late Collisions	Number of frames that were not transmitted since they encountered a collision outside of the normal collision window. Normally, late collision events should occur only rarely, if at all.
Tx Excessive Collisions	Number of consecutive collisions.
Tx Deferred	Number of packets deferred.

15.5.1.2 E-Series Ethernet Utilization Window

The Utilization window shows the percentage of transmit (Tx) and receive (Rx) line bandwidth used by the Ethernet ports during consecutive time segments. The Mode field displays the real-time mode status, such as 100 Full, which is the mode setting configured on the E-Series port. However, if the E-Series port is set to autonegotiate the mode (Auto), this field shows the result of the link negotiation between the E-Series and the peer Ethernet device attached directly to the E-Series port.

The Utilization window provides an Interval menu that enables you to set time intervals of 1 minute, 15 minutes, 1 hour, and 1 day. Line utilization is calculated with the following formulas:

Rx = (inOctets + inPkts * 20) * 8 / 100% interval * maxBaseRate

Tx = (outOctets + outPkts * 20) * 8 / 100% interval * maxBaseRate

The interval is defined in seconds. The maxBaseRate is defined by raw bits per second in one direction for the Ethernet port (that is, 1 Gbps). STS circuit maxBaseRates are shown in Table 15-16.

Table 15-16 MaxBaseRate for STS Circuits

STS	maxBaseRate
STS-1	51840000
STS-3c	155000000
STS-6c	311000000
STS-12c	622000000

Note Line utilization numbers express the average of ingress and egress traffic as a percentage of capacity.

Note The E-Series Ethernet card is a Layer 2 device or switch and supports Trunk Utilization statistics. The Trunk Utilization statistics are similar to the Line Utilization statistics, but shows the percentage of circuit bandwidth used rather than the percentage of line bandwidth used. The Trunk Utilization statistics are accessed via the card view Maintenance tab.

15.5.1.3 E-Series Ethernet History Window

The Ethernet History window lists past Ethernet statistics for the previous time intervals. Depending on the selected time interval, the History window displays the statistics for each port for the number of previous time intervals as shown in Table 15-17. The listed parameters are defined in Table 15-15 on page 15-14.

Table 15-17 Ethernet History Statistics per Time Interval

Time Interval	Number of Intervals Displayed
1 minute	60 previous time intervals
15 minutes	32 previous time intervals
1 hour	24 previous time intervals
1 day (24 hours)	7 previous time intervals

15.5.2 G-Series Ethernet Card Performance Monitoring Parameters

CTC provides Ethernet performance information, including line-level parameters, port bandwidth consumption, and historical Ethernet statistics. The G-Series Ethernet performance information is divided into the Statistics, Utilization, and History tabbed windows within the card view Performance tab window. The following sections describe PM parameters provided for the G1000-4 and G1K-4 Ethernet cards.

15.5.2.1 G-Series Ethernet Statistics Window

The Ethernet statistics window lists Ethernet parameters at the line level. The Statistics window provides buttons to change the statistical values shown. The Baseline button resets the displayed statistics values to zero. The Refresh button manually refreshes statistics. Auto-Refresh sets a time interval at which automatic refresh occurs. The G-Series Statistics window also has a Clear button. The Clear button sets the values on the card to zero, but does not reset the G-Series card.

Table 15-18 on page 15-17 defines the G-Series Ethernet card Statistics parameters.

Table 15-18 G-Series Ethernet Statistics Parameters

Parameter	Meaning
Time Last Cleared	A time stamp indicating the last time statistics were reset.
Link Status	Indicates whether the Ethernet link is receiving a valid Ethernet signal (carrier) from the attached Ethernet device; up means present, and down means not present.
Rx Packets	Number of packets received since the last counter reset.
Rx Bytes	Number of bytes received since the last counter reset.
Tx Packets	Number of packets transmitted since the last counter reset.
Tx Bytes	Number of bytes transmitted since the last counter reset.
Rx Total Errors	Total number of receive errors.
Rx FCS	Number of packets with a Frame Check Sequence (FCS) error. FCS errors indicate frame corruption during transmission.
Rx Alignment	Number of packets with received incomplete frames.
Rx Runts	Measures undersized packets with bad cyclic redundancy check (CRC) errors.
Rx Shorts	Measures undersized packets with good cyclic redundancy check (CRC) errors.
Rx Jabbers	Total number of frames received that exceed the 1548-byte maximum and contain CRC errors.
Rx Giants	Number of packets received that are greater than 1530 bytes in length.
Rx Pause Frames	Number of received Ethernet IEEE 802.3z pause frames.
Tx Pause Frames	Number of transmitted IEEE 802.3z pause frames.
Rx Pkts Dropped Internal Congestion	Number of received packets dropped due to overflow in G-Series frame buffer.
Tx Pkts Dropped Internal Congestion	Number of transmit queue drops due to drops in the G-Series frame buffer.
HDLC Errors	High-level data link control (HDLC) errors received from SDH/SONET (see note).
Rx Unicast Packets	Number of unicast packets received since the last counter reset.
Tx Unicast Packets	Number of unicast packets transmitted.

Table 15-18 G-Series Ethernet Statistics Parameters (continued)

Parameter	Meaning
Rx Multicast Packets	Number of multicast packets received since the last counter reset.
Tx Multicast Packets	Number of multicast packets transmitted.
Rx Broadcast Packets	Number of broadcast packets received since the last counter reset.
Tx Broadcast Packets	Number or broadcast packets transmitted.

Note Do not use the HDLC errors counter to count the number of frames dropped because of HDLC errors, because each frame can fragment into several smaller frames during HDLC error conditions and spurious HDLC frames can also be generated. If HDLC error counters are incrementing when no SDH path problems should be present, it might indicate a problem with the quality of the SDH path. For example, a SDH protection switch generates a set of HLDC errors. But the actual values of these counters are less significant than the fact they are changing.

15.5.2.2 G-Series Ethernet Utilization Window

The Utilization window shows the percentage of transmit (Tx) and receive (Rx) line bandwidth used by the Ethernet ports during consecutive time segments. The Mode field displays the real-time mode status, such as 100 Full, which is the mode setting configured on the G-Series port. However, if the G-Series port is set to autonegotiate the mode (Auto), this field shows the result of the link negotiation between the G-Series and the peer Ethernet device attached directly to the G-Series port.

The Utilization window provides an Interval menu that enables you to set time intervals of 1 minute, 15 \minutes, 1 hour, and 1 day. Line utilization is calculated with the following formulas:

Rx = (inOctets + inPkts * 20) * 8 / 100% interval * maxBaseRate

Tx = (outOctets + outPkts * 20) * 8 / 100% interval * maxBaseRate

The interval is defined in seconds. The maxBaseRate is defined by raw bits per second in one direction for the Ethernet port (that is, 1 Gbps). The maxBaseRate for G-series STS is shown in Table 15-19.

Table 15-19 MaxBaseRate for STS Circuits

STS	maxBaseRate
STS-1	51840000
STS-3c	155000000
STS-6c	311000000
STS-12c	622000000

Note Line utilization numbers express the average of ingress and egress traffic as a percentage of capacity.

Note Unlike the E-Series, the G Series card does not have a display of Trunk Utilization statistics, because the G-Series card is not a Layer 2 device or switch.

15.5.2.3 G-Series Ethernet History Window

The Ethernet History window lists past Ethernet statistics for the previous time intervals. Depending on the selected time interval, the History window displays the statistics for each port for the number of previous time intervals as shown in Table 15-20. The listed parameters are defined in Table 15-18 on page 15-17.

Table 15-20 Ethernet History Statistics Per Time Interval

Time Interval	Number of Intervals Displayed
1 minute	60 previous time intervals
15 minutes	32 previous time intervals
1 hour	24 previous time intervals
1 day (24 hours)	7 previous time intervals

15.5.3 ML-Series Ethernet Card Performance Monitoring Parameters

CTC provides Ethernet performance information for line-level parameters and historical Ethernet statistics. The ML-Series Ethernet performance information is divided into the Ether Ports and Packet over SONET/SDH (POS) Ports tabbed windows within the card view Performance tab window. The following sections describe PM parameters provided for the ML100T-12 and ML1000-2 Ethernet cards.

15.5.3.1 ML-Series Ether Ports Window

The Ether Ports window lists Ethernet PM parameter values for each Ethernet port on the card. Auto-Refresh sets a time interval at which automatic refresh will occur. The PM values are a snapshot captured at the time intervals selected in the Auto-Refresh field. Historical PM values are not stored or displayed.

Table 15-21 defines the ML-Series Ethernet card Ether Ports PM parameters.

Table 15-21 ML-Series Ether Ports PM Parameters

Parameter	Meaning
Rx Bytes	Number of bytes received since the last counter reset.
Rx Packets	Number of packets received since the last counter reset.
Rx Unicast Packets	Number of unicast packets received since the last counter reset.
Rx Multicast Packets	Number of multicast packets received since the last counter reset.
Rx Broadcast Packets	Number of broadcast packets received since the last counter reset.
Rx Giants	Number of packets received that are greater than 1530 bytes in length.
Rx Total Errors	Total number of receive errors.

Table 15-21 ML-Series Ether Ports PM Parameters (continued)

Parameter	Meaning
Rx FCS Errors	Number of packets with a Frame Check Sequence (FCS) error.
Rx Runts	Total number of frames received that are less than 64 bytes in length and have a CRC error.
Rx Jabbers	Total number of frames received that exceed the maximum 1548 bytes and contain CRC errors.
Rx Align Errors	Number of received packets with alignment errors.
Tx Bytes	Number of bytes transmitted since the last counter reset.
Tx Packets	Number of packets transmitted since the last counter reset.
Tx Unicast Packets	Number of unicast packets transmitted.
Tx Multicast Packets	Number of multicast packets transmitted.
Tx Broadcast Packets	Number or broadcast packets transmitted.
Tx Giants	Number of packets transmitted that are greater than 1548 bytes in length.
Tx Collisions	Number of transmitted packets that collided.
Port Drop Counts	Number of received frames dropped at the port level.
Rx Pause Frames	Number of received pause frames.
Rx Threshold Oversizes	Number of received packets larger than the ML-Series remote monitoring (RMON) threshold.
Rx GMAC Drop Counts	Number of received frames dropped by MAC module.
Tx Pause Frames	Number of transmitted pause frames.

15.5.3.2 ML-Series POS Ports Window

The POS Ports window lists PM parameter values for each POS port on the card. Auto-Refresh sets a time interval at which automatic refresh will occur. The PM values are a snapshot captured at the time intervals selected in the Auto-Refresh field. Historical PM values are not stored or displayed.

Table 15-22 defines the ML-Series Ethernet card POS Ports parameters.

Table 15-22 ML-Series POS Ports Parameters

Parameter	Meaning
Rx Pre HDLC Bytes	Number of bytes received prior to the bytes HLDC encapsulation by the policy engine.
Rx Post HDLC Bytes	Number of bytes received after the bytes HLDC encapsulation by the policy engine.
Rx Packets	Number of packets received since the last counter reset.
Rx Normal Packets	Number of packets between the minimum and maximum packet size received.
Rx Shorts	Number of packets below the minimum packet size received.
Rx Runts	Total number of frames received that are less than 64 bytes in length and have a CRC error.

Table 15-22 ML-Series POS Ports Parameters (continued)

Parameter	Meaning
Rx Longs	Counter for the number of received frames that exceed the maximum valid packet length of 1518 bytes.
Rx Total Errors	Total number of receive errors.
Rx CRC Errors	Number of packets with a CRC error.
Rx Input Drop Packets	Number of received packets dropped before input.
Rx Input Abort Packets	Number of received packets aborted before input.
Tx Pre HDLC Bytes	Number of bytes transmitted prior to the bytes HLDC encapsulation by the policy engine.
Tx Post HDLC Bytes	Number of bytes transmitted after the bytes HLDC encapsulation by the policy engine.
Tx Packets	Number of packets transmitted since the last counter reset.
Port Drop Counts	Number of received frames dropped at the port level.

15.6 Performance Monitoring for Optical Cards

The following sections define performance monitoring parameters and definitions for the STM-1, STM1 SH 1310-8, STM-1E, STM-4, STM4 SH 1310-4, STM16 SH AS 1310, STM16 LH AS 1550, STM16 EH 100 GHz, STM64 IO 1310, STM64 SH 1550, STM64 LH 1550, STM64 LH ITU 15xx.xx, TXP_MR_10G, TXP_MR_2.5G, TXPP_MR_2.5G, and MXP_2.5G_10G cards.

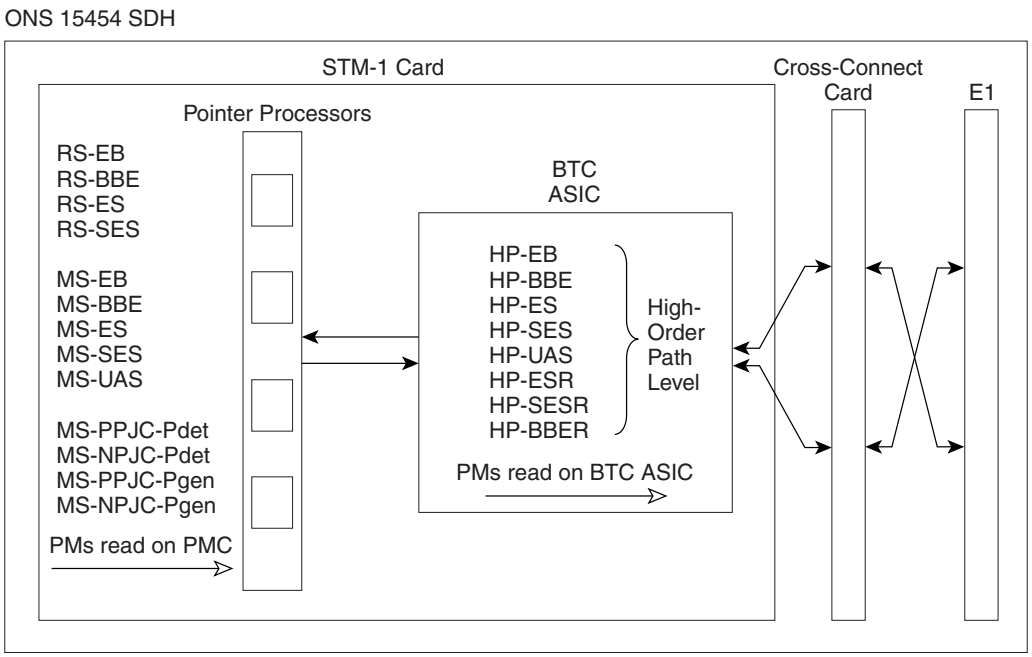
On all STM-N optical cards errors are calculated in bits instead of blocks for B1 and B3. This means there could possibly be a slight difference between what is inserted and what is reported on CTC. In STM4 for example, there are approximately 15000 to 30000 bits per block (per G.826). If there were two bit errors within that block, the standard would require reporting one block error whereas the STM-N cards would have reported two bit errors.

When a tester inputs only single errors during testing, this issue would not appear because a tester is not fast enough to induce two errors within a single block. However, if the test is performed with an error rate, certain error rates could cause two or more errors in a block. For example, the STM4 is roughly 622 Mbps and the block in the STM4 has 15000 bits, there would be about 41467 blocks in a second. If the tester inputs a 10e-4 error rate, that would create 62200 errors per second. If the errors are distributed uniformly, then CTC could potentially report two bit errors within a single block. On the other hand, if the error ratio is 10e-5, then there will be 6220 errors per second. If the errors are not distributed uniformly, then CTC might report one bit error within a single block. In summary, if the errors are distributed equally, then a discrepancy might be seen with the standard when a tester inputs 10e-4 or 10e-3 error rates.

15.6.1 STM-1 Cards Performance Monitoring Parameters

Figure 15-7 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the STM-1 and STM1 SH 1310-8 cards.

Figure 15-7 PM Read Points on the STM-1 and STM1 SH 1310-8 Cards



The PM parameters for the STM-1 and STM1 SH 1310-8 cards are described in Table 15-23 on page 15-22 through Table 15-27 on page 15-24.

Table 15-23 Regenerator Section PM Parameters for the Near-End STM-1 and STM1 SH 1310-8 Cards

Parameter	Definition
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-24 Multiplex Section PM Parameters for the Near-End and Far-End STM-1 and STM1 SH 1310-8 Cards

Parameter	Definition
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.

Table 15-25 1+1 LMSP Protection Switch Count PM Parameters for the Near-End STM-1 and STM1 SH 1310-8 Cards

Parameter	Definition
Note For information about troubleshooting subnetwork connection protection (SNCP) switch counts, refer to the alarm troubleshooting information in the *Cisco ONS 15454 SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, see Chapter 10, "Circuits and Tunnels."	
MS-PSC[1] (1+1 protection)	In a 1+1 protection scheme for a working card, Multiplex Section Protection Switching Count (MS-PSC) is a count of the number of times service switches from a working card to a protection card plus the number of times service switches back to the working card. For a protection card, MS-PSC is a count of the number of times service switches to a working card from a protection card plus the number of times service switches back to the protection card. The MS-PSC PM is only applicable if revertive line-level protection switching is used.
MS-PSD[1]	Multiplex Section Protection Switching Duration (MS-PSD) applies to the length of time, in seconds, that service is carried on another line. For a working line, MS-PSD is a count of the number of seconds that service was carried on the protection line. For the protection line, MS-PSD is a count of the seconds that the line was used to carry service. The MS-PSD PM is only applicable if revertive line-level protection switching is used.

1. Multiplex section-shared protection ring (MS-SPRing) is not supported on the STM-1 card and STM-1E card; therefore, the MS-PSD-W, MS-PSD-S, and MS-PSD-R PM parameters do not increment.

Table 15-26 Pointer Justification Count PM Parameters for the Near-End STM-1 and STM1 SH 1310-8 Cards

Parameter	Definition
Note In CTC, the count fields for HP-PPJC and HP-NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tabs. See the "15.3 Pointer Justification Count Performance Monitoring" section on page 15-3.	
HP-PPJC-Pdet	High-Order, Positive Pointer Justification Count, Path Detected (HP-PPJC-Pdet) is a count of the positive pointer justifications detected on a particular path on an incoming SDH signal.
HP-NPJC-Pdet	High-Order, Negative Pointer Justification Count, Path Detected (HP-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
HP-PPJC-Pgen	High-Order, Positive Pointer Justification Count, Path Generated (HP-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.
HP-NPJC-Pgen	High-Order, Negative Pointer Justification Count, Path Generated (HP-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.
HP-PJCDiff	High-Order Path Pointer Justification Count Difference (HP-PJCDiff) is the absolute value of the difference between the total number of detected pointer justification counts and the total number of generated pointer justification counts. That is, HP-PJCDiff is equal to (HP-PPJC-PGen–HP-NPJC-PGen) – (HP-PPJC-PDet – HP-NPJC-PDet).
HP-PJCS-Pdet	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PDet) is a count of the one-second intervals containing one or more HP-PPJC-PDet or HP-NPJC-PDet.
HP-PJCS-Pgen	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PGen) is a count of the one-second intervals containing one or more HP-PPJC-PGen or HP-NPJC-PGen.

Table 15-27 High-Order VC4 and VC4-Xc Path PM Parameters for the Near-End STM-1 and STM1 SH 1310-8 Cards

Parameter	Definition
Note SDH path PM parameters do not increment unless IPPM is enabled. See the "15.2 Intermediate-Path Performance Monitoring" section on page 15-2.	
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-27 High-Order VC4 and VC4-Xc Path PM Parameters for the Near-End STM-1 and STM1 SH 1310-8 Cards (continued)

Parameter	Definition
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 15-28 High-Order VC4 and VC4-Xc Path PM Parameters for the Far-End STM1 SH 1310-8 Cards

Parameter	Definition
Note Far-end high-order VC4 and VC4-Xc path PM parameters do not apply to the STM1-4 card. **Note** SDH path PM parameters do not increment unless IPPM is enabled. See the "15.2 Intermediate-Path Performance Monitoring" section on page 15-2.	
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.

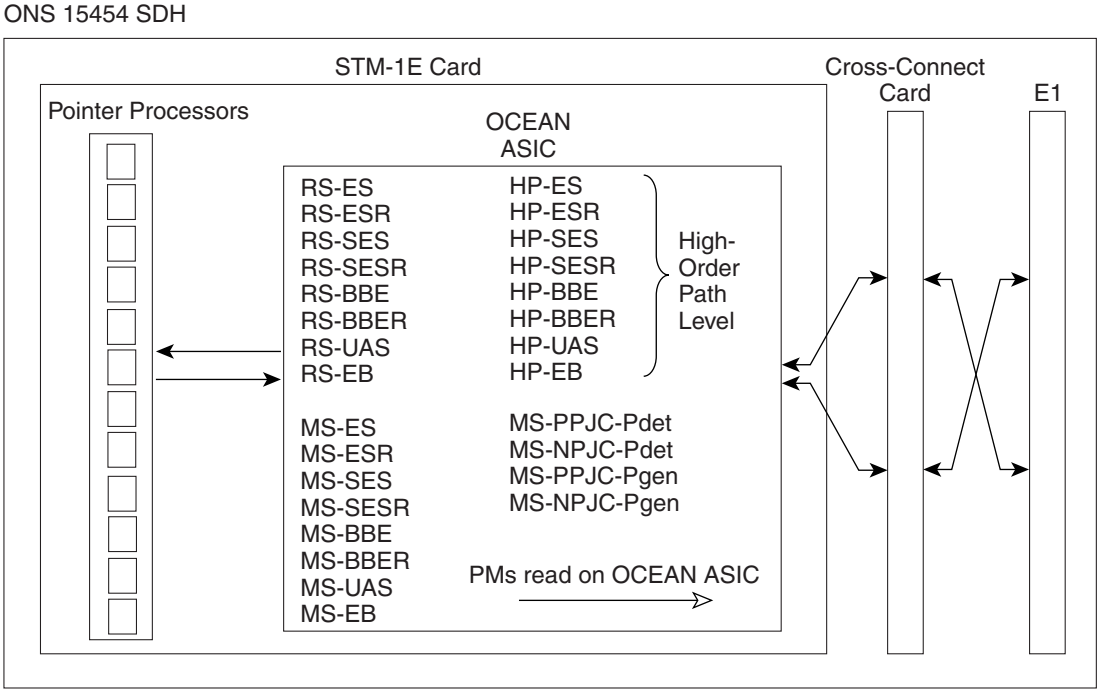
Table 15-28 High-Order VC4 and VC4-Xc Path PM Parameters for the Far-End STM1 SH 1310-8 Cards (continued)

Parameter	Definition
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.6.2 STM-1E Card Performance Monitoring Parameters

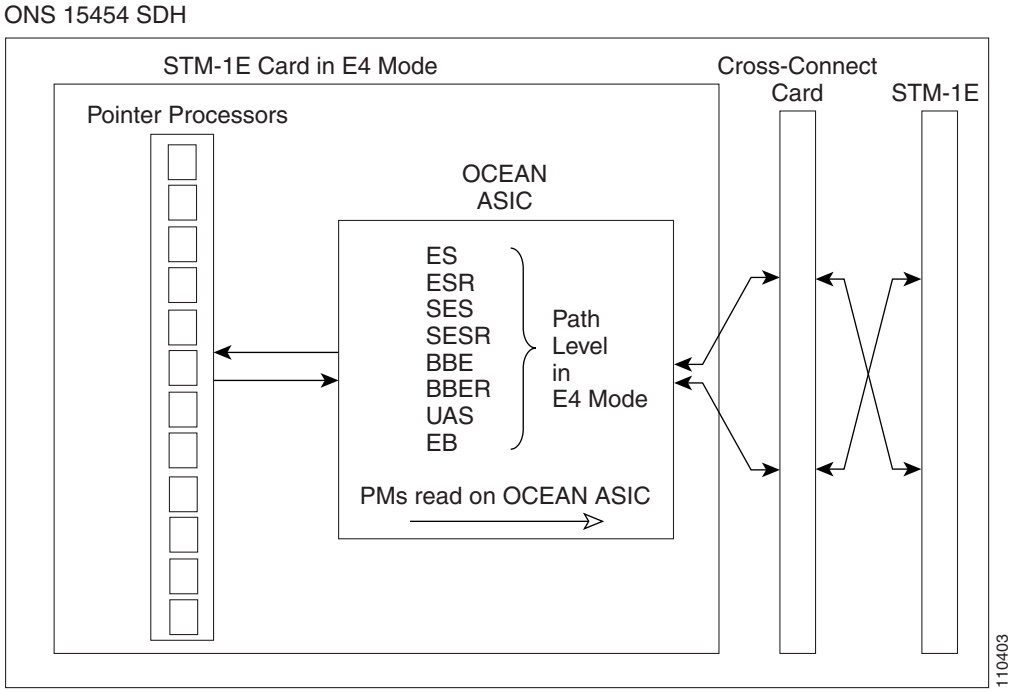
Figure 15-8 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the STM-1E card.

Figure 15-8 PM Read Points on the STM-1E Cards



Ports 9-12 can be provisioned as E4 framed from the Provisioning > Ports tabs. Figure 15-9 shows the VC4 performance monitoring parameters in E4 mode.

Figure 15-9 PM Read Points on the STM-1E Cards in E4 Mode



The PM parameters for the STM-1E cards are described in Table 15-29 on page 15-27 through Table 15-33 on page 15-30.

Table 15-29 Regenerator Section PM Parameters for the Near-End STM-1E Cards

Parameter	Definition
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-ESR	Regenerator Section Errored Second Ratio (RS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
RS-SESR	Regenerator Section Severely Errored Second Ratio (RS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-BBER	Regenerator Section Background Block Error Ratio (RS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

Table 15-29 Regenerator Section PM Parameters for the Near-End STM-1E Cards (continued)

Parameter	Definition
RS-UAS	Regenerator Section Unavailable Second (RS-UAS) is a count of the seconds when the regenerator section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as RS-UASs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as RS-UASs.
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.

Table 15-30 Multiplex Section PM Parameters for the Near-End and Far-End STM-1E Cards

Parameter	Definition
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-ESR	Multiplex Section Errored Second Ratio (MS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-SESR	Multiplex Section Severely Errored Second ratio (MS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-BBER	Multiplex Section Background Block Error Ratio (MS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.

Table 15-31 High-Order VC4 and VC4-Xc Path PM Parameters for the Near-End STM-1E Cards

Parameter	Definition
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.

Table 15-32 Near-End Pointer Justification PM Parameters for STM-1E Cards

Parameter	Definition
Note In CTC, the count fields for PPJC and NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > OC3 Line tabs. See the "15.3 Pointer Justification Count Performance Monitoring" section on page 15-3.	
MS-PPJC-Pdet	Multiplex Section Positive Pointer Justification Count, Path Detected (MS-PPJC-Pdet) is a count of the positive pointer justifications detected on a particular path on an incoming SDH signal.
MS-NPJC-Pdet	Multiplex Section Negative Pointer Justification Count, Path Detected (MS-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
MS-PPJC-Pgen	Multiplex Section Positive Pointer Justification Count, Path Generated (MS-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.

Table 15-32 Near-End Pointer Justification PM Parameters for STM-1E Cards (continued)

Parameter	Definition
MS-NPJC-Pgen	Multiplex Section Negative Pointer Justification Count, Path Generated (MS-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.

Note For information about troubleshooting path protection switch counts, refer to the alarm troubleshooting information in the *Cisco ONS 15454 SDH Troubleshooting Guide*.

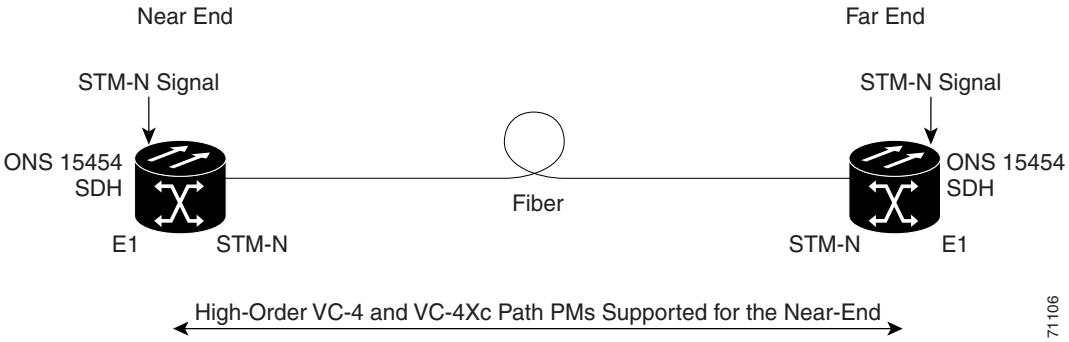
Table 15-33 VC4 and VC4-Xc Path PM Parameters for the STM-1E Card in Far-End E4 Mode

Parameter	Definition
ES	Path Errored Second (ES) is a one-second period with one or more errored blocks or at least one defect.
ESR	Path Errored Second Ratio (ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
SES	Path Severely Errored Seconds (SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
SESR	Path Severely Errored Second Ratio (SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
BBE	Path Background Block Error (BBE) is an errored block not occurring as part of an SES.
BBER	Path Background Block Error Ratio (BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
UAS	Path Unavailable Seconds (UAS) is a count of the seconds when the VC path was unavailable. A high-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
EB	Path Errored Block (EB) indicates that one or more bits are in error within a block.

15.6.3 STM-4 and STM4 SH 1310-4 Card Performance Monitoring Parameters

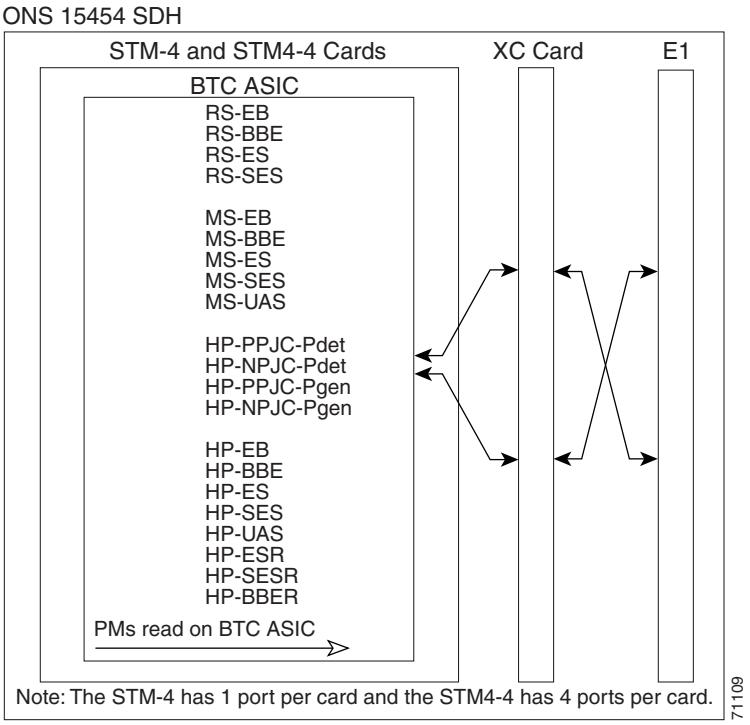
Figure 15-10 shows the signal types that support near-end and far-end PM parameters for the STM-4 and STM4 SH 1310-4 cards. Figure 15-11 on page 15-31 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the STM-4 cards and the STM4 SH 1310-4 card.

Figure 15-10 Monitored Signal Types for the STM-4 and STM4 SH 1310-4 Cards



Note PM parameters on the protect VC4 are not supported for MS-SPRing.

Figure 15-11 PM Read Points on the STM-4 and STM4 SH 1310-4 Cards



The PM parameters for the STM-4 and STM4 SH 1310-4 cards are described in Table 15-34 on page 15-32 through Table 15-38 on page 15-34.

Table 15-34 Regenerator Section PM Parameters for the Near-End and Far-End STM-4 and STM4 SH 1310-4 Cards

Parameter	Definition
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-35 Multiplex Section PM Parameters for the Near-End and Far-End STM-4 and STM4 SH 1310-4 Cards

Parameter	Definition
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.

Table 15-36 Pointer Justification Count PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards

Parameter	Definition
Note In CTC, the count fields for HP-PPJC and HP-NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tabs. See the "15.3 Pointer Justification Count Performance Monitoring" section on page 15-3.	
HP-PPJC-Pdet	High-Order Path Positive Pointer Justification Count, Path Detected (HP-PPJC-Pdet) is a count of the positive pointer justifications detected on a particular path on an incoming SDH signal.

Table 15-36 Pointer Justification Count PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards (continued)

Parameter	Definition
HP-NPJC-Pdet	High-Order Path Negative Pointer Justification Count, Path Detected (HP-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
HP-PPJC-Pgen	High-Order Path Positive Pointer Justification Count, Path Generated (HP-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.
HP-NPJC-Pgen	High-Order Path Negative Pointer Justification Count, Path Generated (HP-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.

Table 15-37 Protection Switch Count PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards

Parameter	Definition
Note For information about troubleshooting SNCP switch counts, refer to the alarm troubleshooting information in the *Cisco ONS 15454 SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, see Chapter 10, "Circuits and Tunnels."	
MS-PSC[1] (MS-SPRing)	For a protect line in a two-fiber ring, Multiplex Section Protection Switching Count (MS-PSC) refers to the number of times a protection switch has occurred either to a particular span's line protection or away from a particular span's line protection. Therefore, if a protection switch occurs on a two-fiber MS-SPRing, the MS-PSC of the protection span to which the traffic is switched will increment, and when the switched traffic returns to its original working span from the protect span, the MS-PSC of the protect span will increment again.
MS-PSC (1+1 protection)	In a 1+1 protection scheme for a working card, Multiplex Section Protection Switching Count (MS-PSC) is a count of the number of times service switches from a working card to a protection card plus the number of times service switches back to the working card. For a protection card, MS-PSC is a count of the number of times service switches to a working card from a protection card plus the number of times service switches back to the protection card. The MS-PSC PM is only applicable if revertive line-level protection switching is used.
MS-PSD[1]	For an active protection line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Duration (MS-PSD) is a count of the number of seconds that the protect line is carrying working traffic following the failure of the working line. MS-PSD increments on the active protect line and MS-PSD-W increments on the failed working line.

Table 15-37 Protection Switch Count PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards (continued)

Parameter	Definition
MS-PSC-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Count-Working (MS-PSC-W) is a count of the number of times traffic switches away from the working capacity in the failed line and back to the working capacity after the failure is cleared. PSC-W increments on the failed working line and PSC increments on the active protect line.
MS-PSD-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Working (MS-PSD-W) is a count of the number of seconds that service was carried on the protection line. MS-PSD-W increments on the failed working line and PSD increments on the active protect line.

1. 4-fiber MS-SPRing is not supported on the STM-4 and STM4 SH 1310-4 cards; therefore, the MS-PSC-S and MS-PSC-R PM parameters do not increment.

Table 15-38 High-Order VC4 and VC4-Xc Path PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards

Parameter	Definition
Note SDH path PM parameters do not increment unless IPPM is enabled. See the "15.2 Intermediate-Path Performance Monitoring" section on page 15-2. The far-end IPPM feature is not supported on the STM-4 and STM4 SH 1310-4 cards. However, SDH path PM parameters can be monitored by logging into the far-end node directly.	
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.

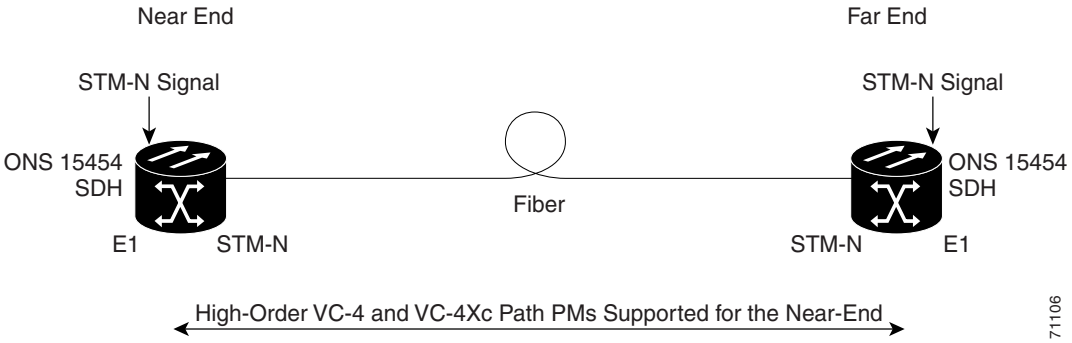
Table 15-38 High-Order VC4 and VC4-Xc Path PM Parameters for the Near-End STM-4 and STM4 SH 1310-4 Cards (continued)

Parameter	Definition
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.6.4 STM-16 and STM-64 Card Performance Monitoring Parameters

Figure 15-12 shows the signal types that support near-end and far-end PM parameters for the STM16 SH AS 1310, STM16 LH AS 1550, STM16 EH 100 GHz, STM64 IO 1310, STM64 SH 1550, STM64 LH 1550, and STM64 LH ITU 15xx.xx cards.

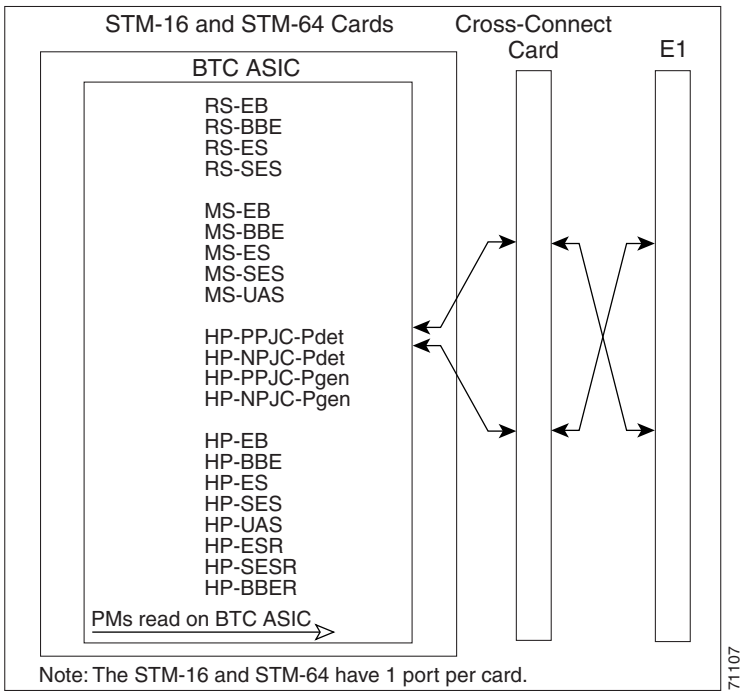
Figure 15-12 Monitored Signal Types for the STM-16 and STM-64 Cards



Note PM parameters on the protect VC4 are not supported for MS-SPRing.

Figure 15-13 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the STM-16 and STM-64 cards

Figure 15-13 PM Read Points on the STM-16 and STM-64 Cards



The PM parameters for the STM-16 and STM-64 cards are described in Table 15-39 through Table 15-43 on page 15-39.

Table 15-39 Regenerator Section PM Parameters for the Near-End and Far-End STM-16 and STM-64 Cards

Parameter	Definition
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-40 Multiplex Section PM Parameters for the Near-End and Far-End STM-16 and STM-64 Cards

Parameter	Definition
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.

Table 15-41 Pointer Justification Count PM Parameters for the Near-End STM-16 and STM-64 Cards

Parameter	Definition
Note In CTC, the count fields for PPJC and NPJC PM parameters appear white and blank unless they are enabled on the Provisioning > Line tabs. See the "15.3 Pointer Justification Count Performance Monitoring" section on page 15-3.	
HP-PPJC-Pdet	High-Order Positive Pointer Justification Count, Path Detected (HP-PPJC-Pdet) is a count of the positive pointer justifications detected on a particular path on an incoming SDH signal.
HP-NPJC-Pdet	High-Order Negative Pointer Justification Count, Path Detected (HP-NPJC-Pdet) is a count of the negative pointer justifications detected on a particular path on an incoming SDH signal.
HP-PPJC-Pgen	High-Order Positive Pointer Justification Count, Path Generated (HP-PPJC-Pgen) is a count of the positive pointer justifications generated for a particular path.
HP-NPJC-Pgen	High-Order Negative Pointer Justification Count, Path Generated (HP-NPJC-Pgen) is a count of the negative pointer justifications generated for a particular path.
HP-PJCDiff	High-Order Path Pointer Justification Count Difference (HP-PJCDiff) is the absolute value of the difference between the total number of detected pointer justification counts and the total number of generated pointer justification counts. That is, HP-PJCDiff is equal to (HP-PPJC-PGen–HP-NPJC-PGen) – (HP-PPJC-PDet–HP-NPJC-PDet).

Table 15-41 Pointer Justification Count PM Parameters for the Near-End STM-16 and STM-64 Cards (continued)

Parameter	Definition
HP-PJCS-Pdet	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PDet) is a count of the one-second intervals containing one or more HP-PPJC-PDet or HP-NPJC-PDet.
HP-PJCS-Pgen	High-Order Path Pointer Justification Count Seconds (HP-PJCS-PGen) is a count of the one-second intervals containing one or more HP-PPJC-PGen or HP-NPJC-PGen.

Table 15-42 Protection Switch Count PM Parameters for the Near-End STM-16 and STM-64 Cards

Parameter	Definition
Note For information about troubleshooting SNCP switch counts, refer to the alarm troubleshooting information in the *Cisco ONS 15454 SDH Troubleshooting Guide*. For information about creating circuits that perform a switch, see Chapter 10, "Circuits and Tunnels."	
MS-PSC (MS-SPRing)	For a protect line in a two-fiber ring, Multiplex Section Protection Switching Count (MS-PSC) refers to the number of times a protection switch has occurred either to a particular span's line protection or away from a particular span's line protection. Therefore, if a protection switch occurs on a two-fiber MS-SPRing, the MS-PSC of the protection span to which the traffic is switched will increment, and when the switched traffic returns to its original working span from the protect span, the MS-PSC of the protect span will increment again.
MS-PSC (1+1 protection)	In a 1+1 protection scheme for a working card, Multiplex Section Protection Switching Count (MS-PSC) is a count of the number of times service switches from a working card to a protection card plus the number of times service switches back to the working card. For a protection card, MS-PSC is a count of the number of times service switches to a working card from a protection card plus the number of times service switches back to the protection card. The MS-PSC PM is only applicable if revertive line-level protection switching is used.
MS-PSD	For an active protection line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Duration (MS-PSD) is a count of the number of seconds that the protect line is carrying working traffic following the failure of the working line. MS-PSD increments on the active protect line and MS-PSD-W increments on the failed working line.

Table 15-42 Protection Switch Count PM Parameters for the Near-End STM-16 and STM-64 Cards (continued)

Parameter	Definition
MS-PSC-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Count-Working (MS-PSC-W) is a count of the number of times traffic switches away from the working capacity in the failed line and back to the working capacity after the failure is cleared. MS-PSC-W increments on the failed working line and MS-PSC increments on the active protect line. For a working line in a four-fiber MS-SPRing, MS-PSC-W is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to the working line. MS-PSC-W increments on the failed line and MS-PSC-R or MS-PSC-S increments on the active protect line.
MS-PSD-W	For a working line in a two-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Working (MS-PSD-W) is a count of the number of seconds that service was carried on the protection line. MS-PSD-W increments on the failed working line and MS-PSD increments on the active protect line.
MS-PSC-S	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Count-Span (MS-PSC-S) is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to the working line. A count is only incremented if span switching is used.
MS-PSD-S	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Span (MS-PSD-S) is a count of the seconds that the protection line was used to carry service. A count is only incremented if span switching is used.
MS-PSC-R	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Count-Ring (MS-PSC-R) is a count of the number of times service switches from a working line to a protection line plus the number of times it switches back to a working line. A count is only incremented if ring switching is used.
MS-PSD-R	In a four-fiber MS-SPRing, Multiplex Section Protection Switching Duration-Ring (MS-PSD-R) is a count of the seconds that the protection line was used to carry service. A count is only incremented if ring switching is used.

Table 15-43 High-Order VC4 and VC4-Xc Path PM Parameters for the STM-16 and STM-64 Cards

Parameter	Definition
Note SDH path PM parameters do not increment unless IPPM is enabled. See the "15.2 Intermediate-Path Performance Monitoring" section on page 15-2. The far-end IPPM feature is not supported on the STM-16 and STM-64 cards. However, SDH path PM parameters can be monitored by logging into the far-end node directly.	
HP-EB	High-Order Path Errored Block (HP-EB) indicates that one or more bits are in error within a block.

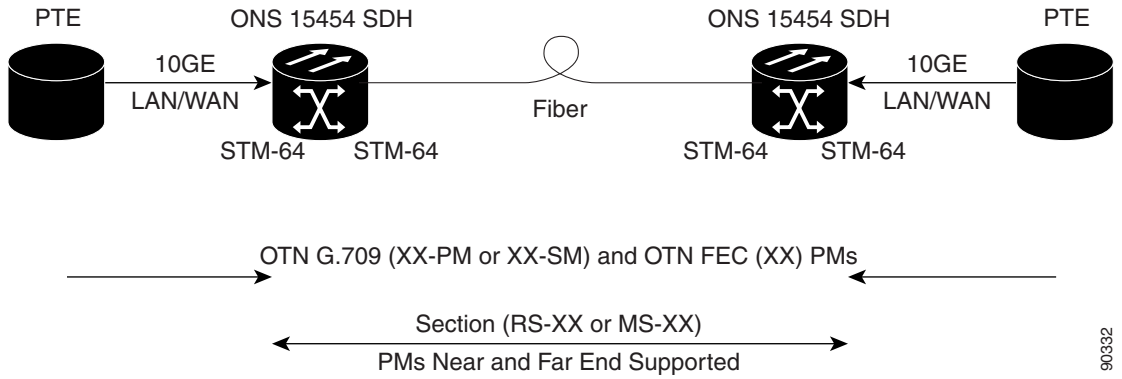
Table 15-43 High-Order VC4 and VC4-Xc Path PM Parameters for the STM-16 and STM-64 Cards (continued)

Parameter	Definition
HP-ES	High-Order Path Errored Second (HP-ES) is a one-second period with one or more errored blocks or at least one defect.
HP-SES	High-Order Path Severely Errored Seconds (HP-SES) is a one-second period containing 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
HP-UAS	High-Order Path Unavailable Seconds (HP-UAS) is a count of the seconds when the VC path was unavailable. A low-order path becomes unavailable when ten consecutive seconds occur that qualify as HP-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as HP-SESs.
HP-BBE	High-Order Path Background Block Error (HP-BBE) is an errored block not occurring as part of an SES.
HP-ESR	High-Order Path Errored Second Ratio (HP-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
HP-SESR	High-Order Path Severely Errored Second Ratio (HP-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
HP-BBER	High-Order Path Background Block Error Ratio (HP-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.

15.6.5 TXP_MR_10G Card Performance Monitoring Parameters

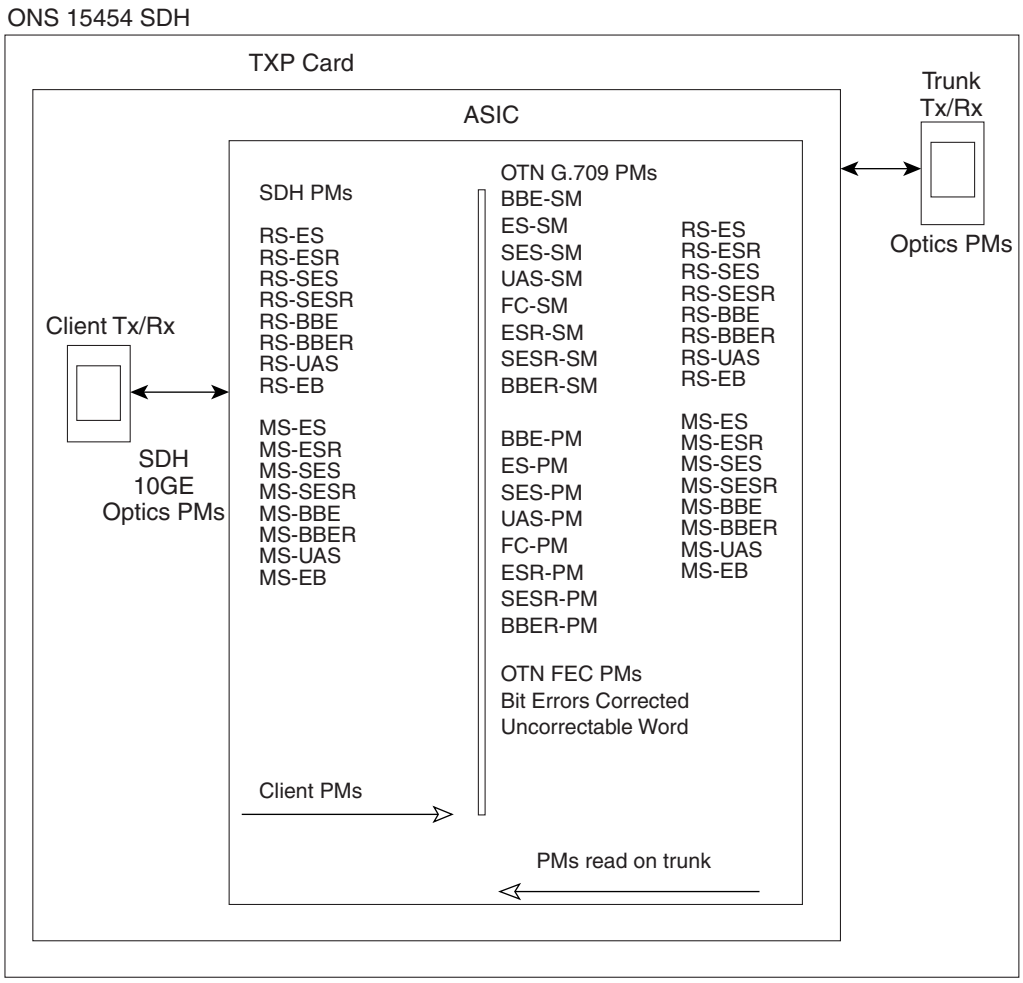
Figure 15-14 shows the signal types that support near-end and far-end PM parameters. Figure 15-15 on page 15-41 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the TXP_MR_10G card.

Figure 15-14 Monitored Signal Types for TXP_MR_10G Cards



Note The XX in Figure 15-14 on page 15-40 represents all PMs listed in Table 15-44 on page 15-41 through Table 15-49 on page 15-45 with the given prefix and/or suffix.

Figure 15-15 PM Read Points on TXP_MR_10G Cards



The PM parameters for the TXP_MR_10G cards are described in Table 15-44 through Table 15-49 on page 15-45.

Table 15-44 Physical Optics PM Parameters for TXP_MR_10G Cards

Parameter	Definition
Laser Bias (Min)	Minimum percentage of laser bias current (%)
Laser Bias (Avg)	Average percentage of laser bias current (%)
Laser Bias (Max)	Maximum percentage of laser bias current (%)
Rx Optical Pwr (Min)	Minimum receive optical power (dBm)
Rx Optical Pwr (Avg)	Average receive optical power (dBm)

Table 15-44 Physical Optics PM Parameters for TXP_MR_10G Cards (continued)

Parameter	Definition
Rx Optical Pwr (Max)	Maximum receive optical power (dBm)
Tx Optical Pwr (Min)	Minimum transmit optical power (dBm)
Tx Optical Pwr (Avg)	Average transmit optical power (dBm)
Tx Optical Pwr (Max)	Maximum transmit optical power (dBm)

Table 15-45 Near-End or Far-End Regenerator Section PM Parameters for TXP_MR_10G Cards

Parameter	Definition
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-ESR	Regenerator Section Errored Second Ratio (RS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
RS-SESR	Regenerator Section Severely Errored Second Ratio (RS-SES) is the ratio of SES to total seconds in available time during a fixed measurement interval.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-BBER	Regenerator Section Background Block Error Ratio (RS-BBE) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
RS-UAS	Regenerator Section Unavailable Second (RS-UAS) is a count of the seconds when the regenerator section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as RS-UASs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as RS-UASs.
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.

Table 15-46 Near-End or Far-End Multiplex Section PM Parameters for TXP_MR_10G Cards

Parameter	Definition
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-ESR	Multiplex Section Errored Second Ratio (MS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.

Table 15-46 Near-End or Far-End Multiplex Section PM Parameters for TXP_MR_10G Cards (continued)

Parameter	Definition
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-SESR	Multiplex Section Severely Errored Second ratio (MS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-BBER	Multiplex Section Background Block Error Ratio (MS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.

Table 15-47 Near-End or Far-End PM Parameters for Ethernet Payloads on TXP_MR_10G Cards

Parameter	Definition
Rx Packets	Number of packets received since the last counter reset.
Rx Bytes	Number of bytes received since the last counter reset.
Tx Packets	Number of packets transmitted since the last counter reset.
Tx Bytes	Number of bytes transmitted since the last counter reset.
Rx Total Errors	Total number of receive errors.
Rx FCS	Number of packets with an FCS error.
Rx Runts	Total number of frames received that are less than 64 bytes in length and have a CRC error.
Rx Jabbers	Total number of frames received that exceed the maximum 1548 bytes and contain CRC errors.
Rx Pause Frames	Number of received pause frames.
Rx Control Frames	A count of MAC control frames passed by the MAC sublayer to the MAC control sublayer.
Rx Unknown Opcode Frames	A count of MAC control frames received that contain an opcode that is not supported by the device.

Table 15-48 Near-End or Far-End OTN G.709 PM Parameters for TXP_MR_10G Cards

Parameter	Definition
BBE-SM	Section Monitoring Background Block Errors (BBE-SM) indicates the number of background block errors recorded in the optical transport network (OTN) section during the PM time interval.
ES-SM	Section monitoring errored seconds (ES-SM) indicates the errored seconds recorded in the OTN section during the PM time interval.
SES-SM	Section Monitoring Severely Errored Seconds (SES-SM) indicates the severely errored seconds recorded in the OTN section during the PM time interval.
UAS-SM	Section Monitoring Unavailable Seconds (UAS-SM) indicates the unavailable seconds recorded in the OTN section during the PM time interval.
FC-SM	Section Monitoring Failure Counts (FC-SM) indicates the failure counts recorded in the OTN section during the PM time interval.
ESR-SM	Section Monitoring Errored Seconds Ratio (ESR-SM) indicates the errored seconds ratio recorded in the OTN section during the PM time interval.
SESR-SM	Section Monitoring Severely Errored Seconds Ratio (SESR-SM) indicates the severely errored seconds ratio recorded in the OTN section during the PM time interval.
BBER-SM	Section Monitoring Background Block Errors Ratio (BBER-SM) indicates the background block errors ratio recorded in the OTN section during the PM time interval.
BBE-PM	Path Monitoring Background Block Errors (BBE-PM) indicates the number of background block errors recorded in the OTN path during the PM time interval.
ES-PM	Path Monitoring Errored Seconds (ES-PM) indicates the errored seconds recorded in the OTN path during the PM time interval.
SES-PM	Path Monitoring Severely Errored Seconds (SES-PM) indicates the severely errored seconds recorded in the OTN path during the PM time interval.
UAS-PM	Path Monitoring Unavailable Seconds (UAS-PM) indicates the unavailable seconds recorded in the OTN path during the PM time interval.
FC-PM	Path Monitoring Failure Counts (FC-PM) indicates the failure counts recorded in the OTN path during the PM time interval.
ESR-PM	Path Monitoring Errored Seconds Ratio (ESR-PM) indicates the errored seconds ratio recorded in the OTN path during the PM time interval.
SESR-PM	Path Monitoring Severely Errored Seconds Ratio (SESR-PM) indicates the severely errored seconds ratio recorded in the OTN path during the PM time interval.
BBER-PM	Path Monitoring Background Block Errors Ratio (BBER-PM) indicates the background block errors ratio recorded in the OTN path during the PM time interval.

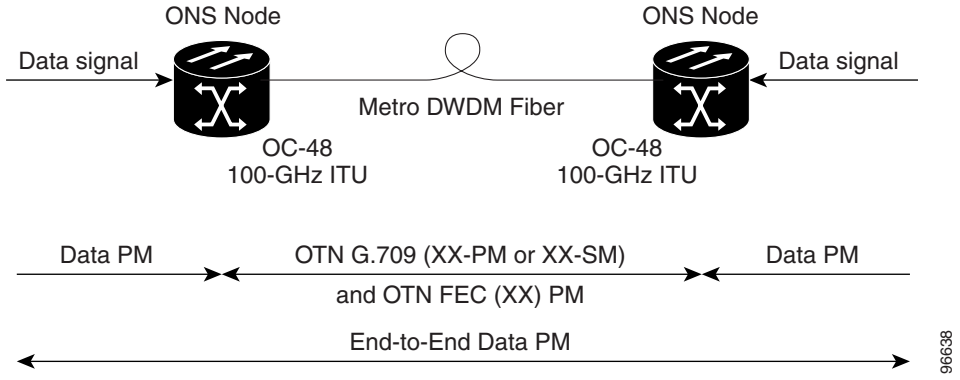
Table 15-49 Near-End or Far-End OTN FEC PM Parameters for TXP_MR_10G Cards

Parameter	Definition
Bit Errors Corrected	The number of bit errors corrected in the dense wavelength division multiplexing (DWDM) trunk line during the PM time interval.
Uncorrectable Words	The number of uncorrectable words detected in the DWDM trunk line during the PM time interval.

15.6.6 TXP_MR_2.5G and TXPP_MR_2.5G Card Performance Monitoring Parameters

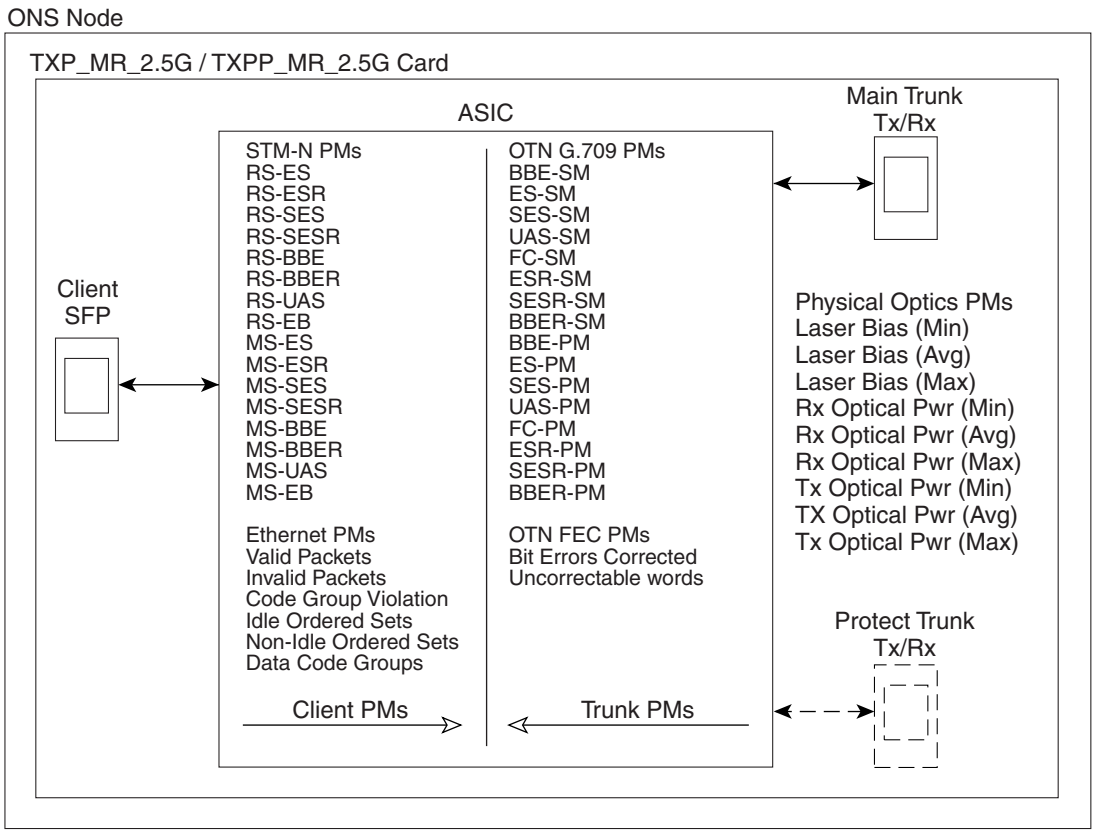
Figure 15-16 on page 15-45 shows the signal types that support near-end and far-end PM parameters. Figure 15-17 on page 15-46 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the TXP_MR_2.5G and TXPP_MR_2.5G cards.

Figure 15-16 Monitored Signal Types for TXP_MR_2.5G and TXPP_MR_2.5G Cards



Note The XX in Figure 15-16 represents all PMs listed in Table 15-50 on page 15-46 through Table 15-55 on page 15-50 with the given prefix and/or suffix.

Figure 15-17 PM Read Points on TXP_MR_2.5G and TXPP_MR_2.5G Cards



The PM parameters for the TXP_MR_2.5G and TXPP_MR_2.5G cards are described in Table 15-50 through Table 15-55 on page 15-50.

Table 15-50 Physical Optics PM Parameters for TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
Laser Bias (Min)	Minimum percentage of laser bias current (%)
Laser Bias (Avg)	Average percentage of laser bias current (%)
Laser Bias (Max)	Maximum percentage of laser bias current (%)
Rx Optical Pwr (Min)	Minimum receive optical power (dBm)
Rx Optical Pwr (Avg)	Average receive optical power (dBm)
Rx Optical Pwr (Max)	Maximum receive optical power (dBm)
Tx Optical Pwr (Min)	Minimum transmit optical power (dBm)
Tx Optical Pwr (Avg)	Average transmit optical power (dBm)
Tx Optical Pwr (Max)	Maximum transmit optical power (dBm)

Table 15-51 Near-End or Far-End Regenerator Section PM Parameters for STM-1, STM-4, and STM-16 Payloads on TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-ESR	Regenerator Section Errored Second Ratio (RS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
RS-SESR	Regenerator Section Severely Errored Second Ratio (RS-SES) is the ratio of SES to total seconds in available time during a fixed measurement interval.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-BBER	Regenerator Section Background Block Error Ratio (RS-BBE) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
RS-UAS	Regenerator Section Unavailable Second (RS-UAS) is a count of the seconds when the regenerator section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as RS-UASs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as RS-UASs.
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.

Table 15-52 Near-End or Far-End Multiplex Section PM Parameters for STM-1, STM-4, and STM-16 Payloads on TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-ESR	Multiplex Section Errored Second Ratio (MS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-SESR	Multiplex Section Severely Errored Second ratio (MS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.

Table 15-52 Near-End or Far-End Multiplex Section PM Parameters for STM-1, STM-4, and STM-16 Payloads on TXP_MR_2.5G and TXPP_MR_2.5G Cards (continued)

Parameter	Definition
MS-BBER	Multiplex Section Background Block Error Ratio (MS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.

Table 15-53 Near-End or Far-End PM Parameters for Ethernet and Fiber Channel Payloads on TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
Valid Packets	A count of received packets that contain non-errored data code groups that have start and end delimiters.
Invalid Packets	A count of received packets that contain errored data code groups that have start and end delimiters.
Code Group Violations	A count of received code groups that do not contain a start or end delimiter.
Idle Ordered Sets	A count of received packets containing idle ordered sets.
Non-Idle Ordered Sets	A count of received packets containing nonidle ordered sets.
Data Code Groups	A count of received data code groups that do not contain ordered sets.

Table 15-54 Near-End or Far-End OTN G.709 PM Parameters for TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
Note Enterprise System Connection (ESCON), DV6000, SDI/D1 video, and high definition television (HDTV) client signals are unframed payload data types. If the configured payload data type is unframed, line threshold provisioning and performance monitoring are not available.	
BBE-SM	Section Monitoring Background Block Errors (BBE-SM) indicates the number of background block errors recorded in the OTN section during the PM time interval.
ES-SM	Section Monitoring Errored Seconds (ES-SM) indicates the errored seconds recorded in the OTN section during the PM time interval.
SES-SM	Section Monitoring Severely Errored Seconds (SES-SM) indicates the severely errored seconds recorded in the OTN section during the PM time interval.

Table 15-54 Near-End or Far-End OTN G.709 PM Parameters for TXP_MR_2.5G and TXPP_MR_2.5G Cards (continued)

Parameter	Definition
UAS-SM	Section Monitoring Unavailable Seconds (UAS-SM) indicates the unavailable seconds recorded in the OTN section during the PM time interval.
FC-SM	Section Monitoring Failure Counts (FC-SM) indicates the failure counts recorded in the OTN section during the PM time interval.
ESR-SM	Section Monitoring Errored Seconds Ratio (ESR-SM) indicates the errored seconds ratio recorded in the OTN section during the PM time interval.
SESR-SM	Section Monitoring Severely Errored Seconds Ratio (SESR-SM) indicates the severely errored seconds ratio recorded in the OTN section during the PM time interval.
BBER-SM	Section Monitoring Background Block Errors Ratio (BBER-SM) indicates the background block errors ratio recorded in the OTN section during the PM time interval.
BBE-PM	Path Monitoring Background Block Errors (BBE-PM) indicates the number of background block errors recorded in the OTN path during the PM time interval.
ES-PM	Path Monitoring Errored Seconds (ES-PM) indicates the errored seconds recorded in the OTN path during the PM time interval.
SES-PM	Path Monitoring Severely Errored Seconds (SES-PM) indicates the severely errored seconds recorded in the OTN path during the PM time interval.
UAS-PM	Path Monitoring Unavailable Seconds (UAS-PM) indicates the unavailable seconds recorded in the OTN path during the PM time interval.
FC-PM	Path Monitoring Failure Counts (FC-PM) indicates the failure counts recorded in the OTN path during the PM time interval.
ESR-PM	Path Monitoring Errored Seconds Ratio (ESR-PM) indicates the errored seconds ratio recorded in the OTN path during the PM time interval.
SESR-PM	Path Monitoring Severely Errored Seconds Ratio (SESR-PM) indicates the severely errored seconds ratio recorded in the OTN path during the PM time interval.
BBER-PM	Path Monitoring Background Block Errors Ratio (BBER-PM) indicates the background block errors ratio recorded in the OTN path during the PM time interval.

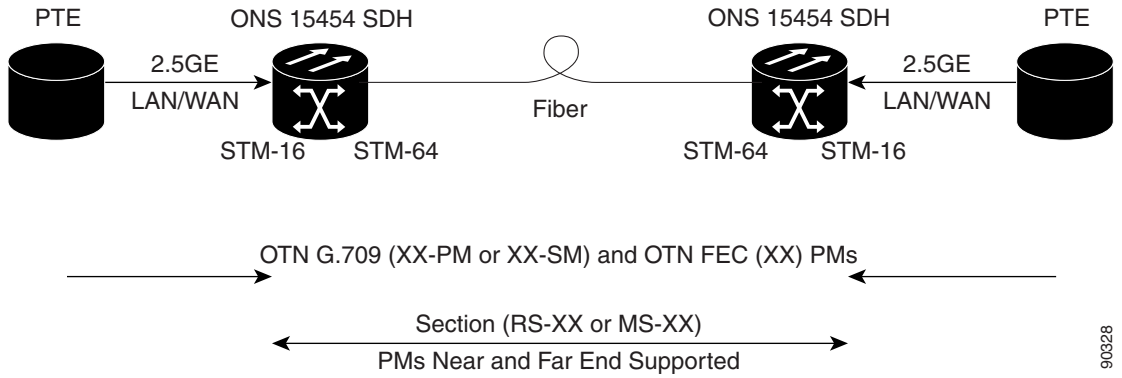
Table 15-55 Near-End or Far-End OTN FEC PM Parameters for TXP_MR_2.5G and TXPP_MR_2.5G Cards

Parameter	Definition
Bit Errors Corrected	The number of bit errors corrected in the DWDM trunk line during the PM time interval.
Uncorrectable Words	The number of uncorrectable words detected in the DWDM trunk line during the PM time interval.

15.6.7 MXP_2.5G_10G Card Performance Monitoring Parameters

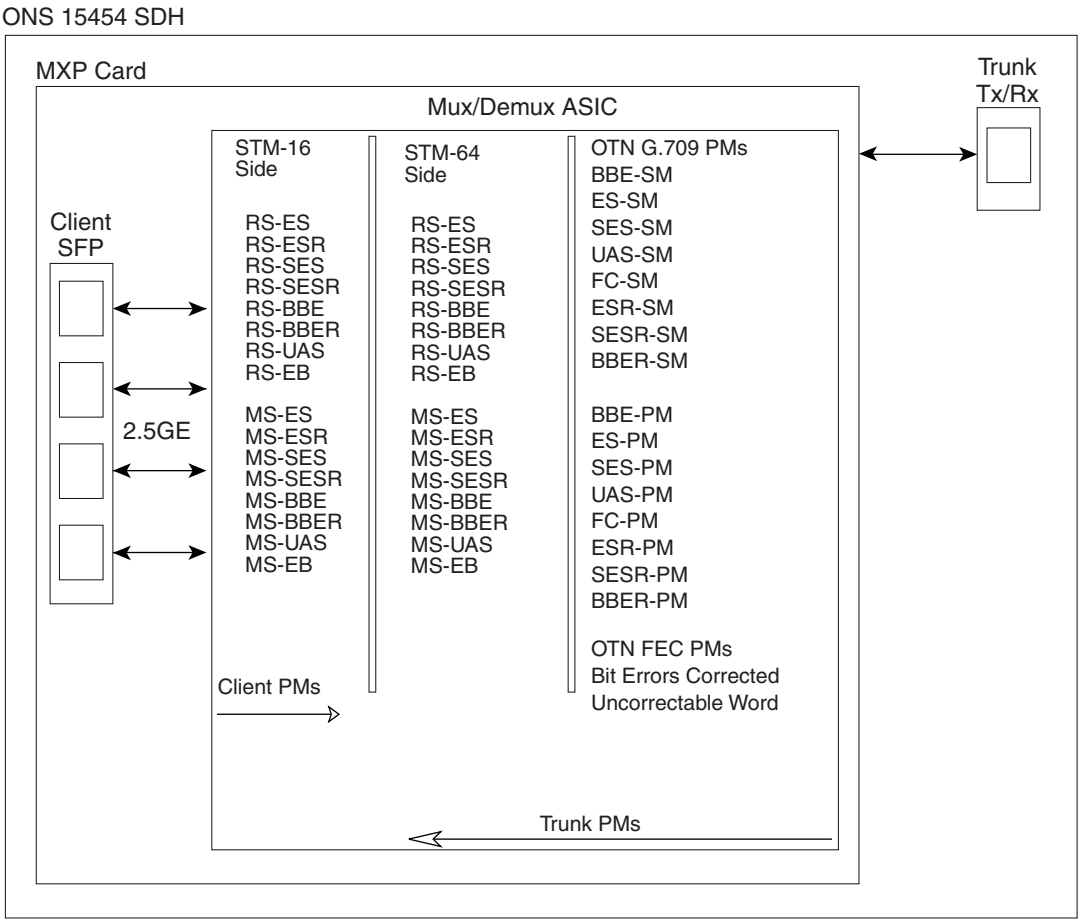
Figure 15-18 shows the signal types that support near-end and far-end PM parameters. Figure 15-19 on page 15-51 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the MXP_2.5G_10G card.

Figure 15-18 Monitored Signal Types for MXP_2.5G_10G Cards



Note The XX in Figure 15-18 on page 15-50 represents all PMs listed in Table 15-56 on page 15-51 through Table 15-60 on page 15-54 with the given prefix and/or suffix.

Figure 15-19 PM Read Points on MXP_2.5G_10G Cards



The PM parameters for the MXP_2.5G_10G cards are described in Table 15-56 through Table 15-60 on page 15-54.

Table 15-56 Physical Optics PM Parameters for MXP_2.5G_10G Cards

Parameter	Definition
Laser Bias (Min)	Minimum percentage of laser bias current (%)
Laser Bias (Avg)	Average percentage of laser bias current (%)
Laser Bias (Max)	Maximum percentage of laser bias current (%)
Rx Optical Pwr (Min)	Minimum receive optical power (dBm)
Rx Optical Pwr (Avg)	Average receive optical power (dBm)
Rx Optical Pwr (Max)	Maximum receive optical power (dBm)
Tx Optical Pwr (Min)	Minimum transmit optical power (dBm)
TX Optical Pwr (Avg)	Average transmit optical power (dBm)
Tx Optical Pwr (Max)	Maximum transmit optical power (dBm)

Table 15-57 Near-End or Far-End Regenerator Section PM Parameters for MXP_2.5G_10G Cards

Parameter	Definition
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-ESR	Regenerator Section Errored Second Ratio (RS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.
RS-SESR	Regenerator Section Severely Errored Second Ratio (RS-SES) is the ratio of SES to total seconds in available time during a fixed measurement interval.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.
RS-BBER	Regenerator Section Background Block Error Ratio (RS-BBE) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
RS-UAS	Regenerator Section Unavailable Second (RS-UAS) is a count of the seconds when the regenerator section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as RS-UASs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as RS-UASs.
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.

Table 15-58 Near-End or Far-End Multiplex Section PM Parameters for MXP_2.5G_10G Cards

Parameter	Definition
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-ESR	Multiplex Section Errored Second Ratio (MS-ESR) is the ratio of errored seconds to total seconds in available time during a fixed measurement interval.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-SESR	Multiplex Section Severely Errored Second ratio (MS-SESR) is the ratio of SES to total seconds in available time during a fixed measurement interval.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.

Table 15-58 Near-End or Far-End Multiplex Section PM Parameters for MXP_2.5G_10G Cards (continued)

Parameter	Definition
MS-BBER	Multiplex Section Background Block Error Ratio (MS-BBER) is the ratio of BBE to total blocks in available time during a fixed measurement interval. The count of total blocks excludes all blocks during SESs.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.

Table 15-59 Near-End or Far-End OTN G.709 PM Parameters for MXP_2.5G_10G Cards

Parameter	Definition
BBE-SM	Section Monitoring Background Block Errors (BBE-SM) indicates the number of background block errors recorded in the OTN section during the PM time interval.
ES-SM	Section Monitoring Errored Seconds (ES-SM) indicates the errored seconds recorded in the OTN section during the PM time interval.
SES-SM	Section Monitoring Severely Errored Seconds (SES-SM) indicates the severely errored seconds recorded in the OTN section during the PM time interval.
UAS-SM	Section Monitoring Unavailable Seconds (UAS-SM) indicates the unavailable seconds recorded in the OTN section during the PM time interval.
FC-SM	Section Monitoring Failure Counts (FC-SM) indicates the failure counts recorded in the OTN section during the PM time interval.
ESR-SM	Section Monitoring Errored Seconds Ratio (ESR-SM) indicates the errored seconds ratio recorded in the OTN section during the PM time interval.
SESR-SM	Section Monitoring Severely Errored Seconds Ratio (SESR-SM) indicates the severely errored seconds ratio recorded in the OTN section during the PM time interval.
BBER-SM	Section Monitoring Background Block Errors Ratio (BBER-SM) indicates the background block errors ratio recorded in the OTN section during the PM time interval.
BBE-PM	Path Monitoring Background Block Errors (BBE-PM) indicates the number of background block errors recorded in the OTN path during the PM time interval.
ES-PM	Path Monitoring Errored Seconds (ES-PM) indicates the errored seconds recorded in the OTN path during the PM time interval.

Table 15-59 Near-End or Far-End OTN G.709 PM Parameters for MXP_2.5G_10G Cards (continued)

Parameter	Definition
SES-PM	Path Monitoring Severely Errored Seconds (SES-PM) indicates the severely errored seconds recorded in the OTN path during the PM time interval.
UAS-PM	Path Monitoring Unavailable Seconds (UAS-PM) indicates the unavailable seconds recorded in the OTN path during the PM time interval.
FC-PM	Path Monitoring Failure Counts (FC-PM) indicates the failure counts recorded in the OTN path during the PM time interval.
ESR-PM	Path Monitoring Errored Seconds Ratio (ESR-PM) indicates the errored seconds ratio recorded in the OTN path during the PM time interval.
SESR-PM	Path Monitoring Severely Errored Seconds Ratio (SESR-PM) indicates the severely errored seconds ratio recorded in the OTN path during the PM time interval.
BBER-PM	Path Monitoring Background Block Errors Ratio (BBER-PM) indicates the background block errors ratio recorded in the OTN path during the PM time interval.

Table 15-60 Near-End or Far-End OTN FEC PM Parameters for MXP_2.5G_10G Cards

Parameter	Definition
Bit Errors	The number of bit errors corrected in the DWDM trunk line during the PM time interval.
Uncorrectable Words	The number of uncorrectable words detected in the DWDM trunk line during the PM time interval.

15.7 Performance Monitoring for the Fiber Channel Card

The following sections define performance monitoring parameters and definitions for the FC_MR-4 card.

15.7.1 FC_MR-4 Card Performance Monitoring Parameters

CTC provides FC_MR-4 performance information, including line-level parameters, port bandwidth consumption, and historical statistics. The FC_MR-4 card performance information is divided into the Statistics, Utilization, and History tabbed windows within the card view Performance tab window.

15.7.1.1 FC_MR-4 Statistics Window

The statistics window lists parameters at the line level. The Statistics window provides buttons to change the statistical values shown. The Baseline button resets the displayed statistics values to zero. The Refresh button manually refreshes statistics. Auto-Refresh sets a time interval at which automatic refresh occurs. The Statistics window also has a Clear button. The Clear button sets the values on the card to zero. All counters on the card are cleared.

Table 15-61 defines the FC_MR-4 card Statistics parameters.

Table 15-61 FC_MR-4 Statistics Parameters

Parameter	Meaning
Time Last Cleared	A time stamp indicating the last time statistics were reset.
Link Status	Indicates whether the fibre channel link is receiving a valid fibre channel signal (carrier) from the attached fibre channel device; up means present, and down means not present.
Rx Frames	A count of the number of fiber channel frames received without errors.
Rx Bytes	A count of the number of bytes received without error for the fiber channel payload.
Tx Frames	A count of the number of transmitted fiber channel frames.
Tx Bytes	A count of the number of bytes transmitted from the fiber channel frame.
8b/10b Errors	A count of 10b errors received by the serial/deserializer (serdes 8b/10b).
Encoding Disparity Errors	A count of the disparity errors received by serdes.
Link Recoveries	A count of the FC-MR software initiated link recovery attempts toward the FC line side because of SONET protection switches.
Rx Frames bad CRC	A count of the received fiber channel frames with errored CRCs.
Tx Frames bad CRC	A count of the transmitted fiber channel frames with errored CRCs.
Rx Undersized Frames	A count of the received fiber channel frames < 36 bytes including CRC, start of frame (SOF), and end of frame (EOF).
Rx Oversized Frames	A count of the received fiber channel frames > 2116 bytes of the payload. Four bytes are allowed for supporting VSAN tags sent.
GFP Rx HDR Single-bit Errors	A count of generic framing procedure (GFP) single bit errors in the core header error check (CHEC).
GFP Rx HDR Multi-bit Errors	A count of GFP multibit errors in CHEC.
GGFP Rx Frames Invalid Type	A count of GFP invalid user payload identifier (UPI) field in the type field.
GFP Rx Superblk CRC Errors	A count of superblock CRC errors in the transparent GFP frame.

15.7.1.2 FC_MR-4 Utilization Window

The Utilization window shows the percentage of transmit (Tx) and receive (Rx) line bandwidth used by the ports during consecutive time segments. The Utilization window provides an Interval menu that enables you to set time intervals of 1 minute, 15 minutes, 1 hour, and 1 day. Line utilization is calculated with the following formulas:

Rx = (inOctets + inPkts * 24) * 8 / 100% interval * maxBaseRate

Tx = (outOctets + outPkts * 24) * 8 / 100% interval * maxBaseRate

The interval is defined in seconds. The maxBaseRate is defined by raw bits per second in one direction for the port (that is, 1 Gbps or 2 Gbps). The maxBaseRate for FC_MR-4 cards is shown in Table 15-62.

Table 15-62 maxBaseRate for STS Circuits

STS	maxBaseRate
STS-24	850000000
STS-48	850000000 x 2[1]

1. For 1 G of bit rate being transported, there is only 850 Mbps of actual data because of 8b->10b conversion. Similarly, for 2 G of bit rate being transported there is only 850 Mbps x 2 of actual data.

Note Line utilization numbers express the average of ingress and egress traffic as a percentage of capacity.

15.7.1.3 FC_MR-4 History Window

The History window lists past FC_MR-4 statistics for the previous time intervals. Depending on the selected time interval, the History window displays the statistics for each port for the number of previous time intervals as shown in Table 15-63. The listed parameters are defined in Table 15-61 on page 15-55.

Table 15-63 FC_MR-4 History Statistics per Time Interval

Time Interval	Number of Intervals Displayed
1 minute	60 previous time intervals
15 minutes	32 previous time intervals
1 hour	24 previous time intervals
1 day (24 hours)	7 previous time intervals

15.8 Performance Monitoring for DWDM Cards

The following sections define performance monitoring parameters and definitions for the OPT-PRE, OPT-BST, 32 MUX-O, 32 DMX-O, 4MD-xx.x, AD-1C-xx.x, AD-2C-xx.x, AD-4C-xx.x, AD-1B-xx.x, AD-4B-xx.x, OSCM, and OSC-CSM DWDM cards.

15.8.1 Optical Amplifier Card Performance Monitoring Parameters

The PM parameters for the OPT-PRE and OPT-BST cards are described in Table 15-64 and Table 15-65.

Table 15-64 Optical Line PM Parameters for OPT-PRE and OPT-BST Cards

Parameter	Definition
Optical Pwr (Min)	Minimum received optical power (dBm)
Optical Pwr (Avg)	Average received optical power (dBm)
Optical Pwr (Max)	Maximum received optical power (dBm)

Table 15-65 Optical Amplifier Line PM Parameters for OPT-PRE and OPT-BST Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

15.8.2 Multiplexer and Demultiplexer Card Performance Monitoring Parameters

The PM parameters for the 32 MUX-O and 32 DMX-O cards are described in Table 15-66 and Table 15-67.

Table 15-66 Optical Channel PMs for 32 MUX-O and 32 DMX-O Cards

Parameter	Definition
Optical Pwr (Min)	Minimum receive optical power (dBm)
Optical Pwr (Avg)	Average receive optical power (dBm)
Optical Pwr (Max)	Maximum receive optical power (dBm)

Table 15-67 Optical Line PMs for 32 MUX-O and 32 DMX-O Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

15.8.3 4MD-xx.x Card Performance Monitoring Parameters

The PM parameters for the 4MD-xx.x cards are described in Table 15-68 and Table 15-69.

Table 15-68 Optical Channel PMs for 4MD-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum receive optical power (dBm)
Optical Pwr (Avg)	Average receive optical power (dBm)
Optical Pwr (Max)	Maximum receive optical power (dBm)

Table 15-69 Optical Band PMs for 4MD-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

15.8.4 OADM Channel Filter Card Performance Monitoring Parameters

The PM parameters for the AD-1C-xx.x, AD-2C-xx.x, and AD-4C-xx.x cards are described in Table 15-70 and Table 15-71.

Table 15-70 Optical Channel PMs for AD-1C-xx.x, AD-2C-xx.x, and AD-4C-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum receive optical power (dBm)
Optical Pwr (Avg)	Average receive optical power (dBm)
Optical Pwr (Max)	Maximum receive optical power (dBm)

Table 15-71 Optical Line PMs for AD-1C-xx.x, AD-2C-xx.x, and AD-4C-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

15.8.5 OADM Band Filter Card Performance Monitoring Parameters

The PM parameters for the AD-1B-xx.x and AD-4B-xx.x cards are described in Table 15-72 and Table 15-73.

Table 15-72 Optical Line PMs for AD-1B-xx.x and AD-4B-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum receive optical power (dBm)
Optical Pwr (Avg)	Average receive optical power (dBm)
Optical Pwr (Max)	Maximum receive optical power (dBm)

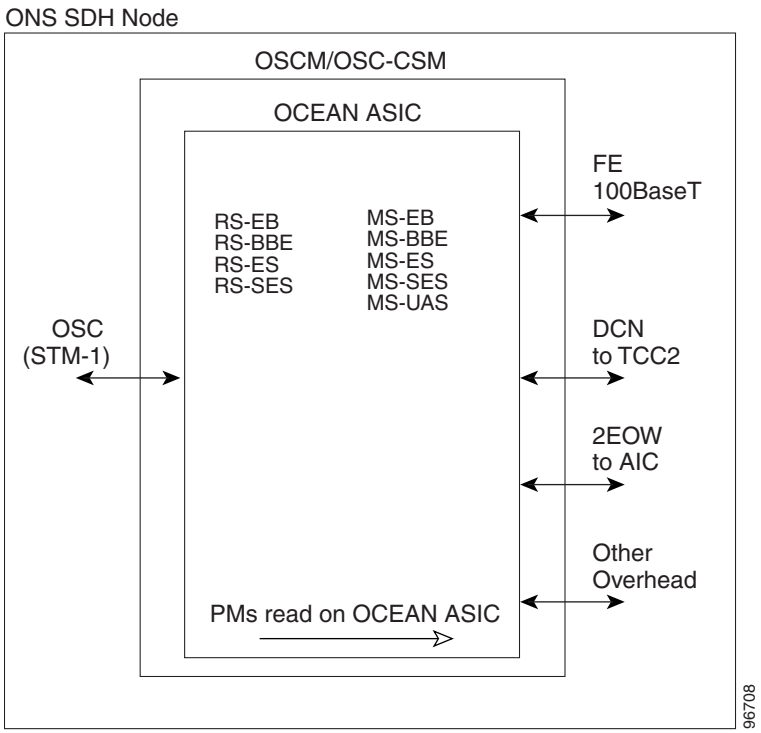
Table 15-73 Optical Band PMs for AD-1B-xx.x and AD-4B-xx.x Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

15.8.6 Optical Service Channel Card Performance Monitoring Parameters

Figure 15-20 shows where overhead bytes detected on the ASICs produce performance monitoring parameters for the OSCM and OSC-CSM cards.

Figure 15-20 PM Read Points on OSCM and OSC-CSM Cards



The PM parameters for the OSCM and OSC-CSM cards are described in Table 15-74 through Table 15-76 on page 15-61.

Table 15-74 Optical Line PMs for OSCM and OSC-CSM Cards

Parameter	Definition
Optical Pwr (Min)	Minimum transmit optical power (dBm)
Optical Pwr (Avg)	Average transmit optical power (dBm)
Optical Pwr (Max)	Maximum transmit optical power (dBm)

Table 15-75 Near-End Regenerator Section PM Parameters for OSCM and OSC-CSM Cards

Parameter	Definition
RS-EB	Regenerator Section Errored Block (RS-EB) indicates that one or more bits are in error within a block.
RS-BBE	Regenerator Section Background Block Error (RS-BBE) is an errored block not occurring as part of an SES.

Table 15-75 Near-End Regenerator Section PM Parameters for OSCM and OSC-CSM Cards (continued)

Parameter	Definition
RS-ES	Regenerator Section Errored Second (RS-ES) is a one-second period with one or more errored blocks or at least one defect.
RS-SES	Regenerator Section Severely Errored Second (RS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES.

Table 15-76 Near-End or Far-End Multiplex Section PM Parameters for OSCM and OSC-CSM Cards

Parameter	Definition
MS-EB	Multiplex Section Errored Block (MS-EB) indicates that one or more bits are in error within a block.
MS-BBE	Multiplex Section Background Block Error (MS-BBE) is an errored block not occurring as part of an SES.
MS-ES	Multiplex Section Errored Second (MS-ES) is a one-second period with one or more errored blocks or at least one defect.
MS-SES	Multiplex Section Severely Errored Second (MS-SES) is a one-second period which contains 30 percent or more errored blocks or at least one defect. SES is a subset of ES. For more information, see ITU-T G.829 Section 5.1.3.
MS-UAS	Multiplex Section Unavailable Seconds (MS-UAS) is a count of the seconds when the section was unavailable. A section becomes unavailable when ten consecutive seconds occur that qualify as MS-SESs, and it continues to be unavailable until ten consecutive seconds occur that do not qualify as MS-SESs. When the condition is entered, MS-SESs decrement and then count toward MS-UAS.